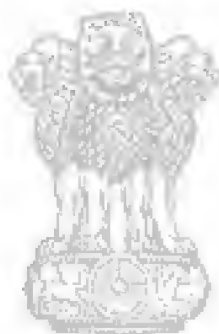




REPORT
OF THE
WORKING GROUP ON TECHNICAL
EDUCATION
AND
VOCATIONAL TRAINING

GOVERNMENT OF INDIA
PLANNING COMMISSION, APRIL, 1960



सत्यमेव जयते

FOREWORD

The primary aim of the Government in a welfare state like ours is raising the standard of living of the people. Large scale industrial development and production are the *sine qua non* of any nation building activity intended to achieve this goal. Scientists, engineers and technologists are essential for forging ahead towards this end. As our industries develop, and as our production is stepped up, the need for engineers and technologists will also increase steeply; and there should be a corresponding increase in the number of skilled technicians and craftsmen. For this purpose an accelerated programme of expansion of technical education was undertaken during the Second Plan period at a cost of nearly Rs. 60 crores as development expenditure for degree and diploma courses only, and the tempo has to be maintained through the Third and successive plans.

However, quantitative expansion is only half the effort. It is equally important to set new standards, to examine existing patterns and to suggest new ways of organisation from the point of view of economy and efficiency. The opportunities created call for new methods of training, teaching and organisation of the whole field of technical education. Our work in this all important field of national endeavour naturally leads us to a study of developments in U.S.A., U.K., U.S.S.R., and other advanced countries. While we have to learn many a lesson from them, we must bear in mind the fact that our attempt should not be just a copy of their ideas, ideals and methods, but to evolve a pattern of progress which is closely related to our national needs and aspirations, and is in tune with our historical development. The Working Group on Technical Education and Vocational Training and its sub-committees addressed themselves to this task. The Group met several times and discussed all aspects of the subject. Certain concepts and ideas of technical education and vocational training, on which the Group has expressed its views, have been embodied in Chapters II, III and IV which form an introduction to the subject. Chapter V gives an account of how educational facilities expanded during the Second Plan, and Chapter VI deals with the requirements in the Third and Fourth Plans and indicates the measures that should be taken for further expansion. Suggestions in regard to improvement and new ideas on patterns of technical education and vocational training have been stated in the form of recommendations in Chapter VII. Financial implications have been worked out in Chapter VIII and problems of qualitative improvement have been briefly touched upon in Chapter IX.

Since the Working Group last met on 26th December, 1959, one of its sub-committees, dealing with the assessment of personnel required in the Third and the Fourth Plans and facilities for training, has collected further information. And the financial implications of various recommendations along with the physical targets have been revised in the light of further data obtained; this has been explained in the report.

The optimum size of a College and Polytechnic and their changing patterns have been discussed, and due emphasis has been laid on part-time courses, short-term courses and correspondence courses. Experts in the field of technical education have examined very carefully the new concepts in the light of our requirements in the Third and successive plans and it is hoped that speedy and vigorous action will be taken on some of the important recommendations.

The considerable amount of information and statistical data which the Working Group received from different Ministries, State Governments, institutions, representatives of public and private sectors, and other organisations, have been summed up in the form of tables in the body of the report and more useful information has been presented in statements included as Appendices. A list of papers, notes and memoranda considered by the Working Group, and its committees, appears in Appendix III as well as in the select bibliography.

I would be remiss if I do not express here my sincere thanks to the different Ministries, State Governments, institutions, representatives of public and private sectors, and other organisations for their cooperation. They furnished us valuable material and statistical data which has proved of great help. The colleagues who served with me on the Working Group, and to whom I owe a debt of gratitude, have not only helped in supplying information from their side but also contributed in a large measure in attacking the problem from an angle in the light of scientific and technological developments we are witnessing today.

Finally, I would like to record my appreciation of the work done by the staff of the Education Division, Planning Commission and in particular Shri K. L. Joshi, Director, Education Division, who acted as our Member-Secretary.

New Delhi,
20-4-1960.

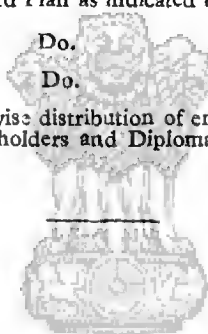
Sd./- M. S. Thacker,
Chairman,
Working Group on Technical Education
and Vocational Training.

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CHAPTER I

APPOINTMENT OF THE WORKING GROUP ON TECHNICAL EDUCATION AND VOCATIONAL TRAINING

Planning Commission in pursuance of the recommendations of the National Development Council at their meeting held in New Delhi on November 8 & 9, 1958, decided to appoint Working Groups for different subjects for considering various issues relating to the third five year plan. A decision was taken at a meeting of the Secretaries of different Ministries of the Government of India on December 4 & 5, 1958, that Working Groups of representative members and experts be appointed in different subjects for the purpose. The Working Group on Technical Education and Vocational Training was appointed in February 1959, with the personnel mentioned in Appendix-I and with Prof. M. S. Thacker, Secretary, Ministry of Scientific Research & Cultural Affairs, as the Chairman. It was agreed that the Working Group should include a few persons outside the Government, for instance, those connected with the Association of Principals of Technical Institutions, All India Council for Technical Education and experts on different branches of engineering; there were also to be representatives of different Ministries, such as, Ministries of Steel, Mines & Fuel, Commerce & Industry, Labour & Employment, Railways, Defence, Irrigation & Power, Works, Housing & Supply, etc. The scope of the work of the Working Group was further expanded to include the examination of the programmes of vocational training of the Ministry of Labour & Employment and allied problems. It was also decided that the Education Division of the Planning Commission should supply the Secretariat to the Working Group with Shri K. L. Joshi, Director (Education), Planning Commission, as Member-Secretary.

2. The Working Group was requested to consider the question of development of technical education and vocational training in the third and subsequent plans, in relation to the following questions, amongst others:—

(1) to consider the general lines along which facilities for technical education and training should be expanded, provision made for facilities for practical education in industrial establishments and for facilities for scientific research, pure and applied;

(2) to assess the extent of development of facilities for technical education and the likely shortages at the end of the second five year plan;

(3) to estimate the probable requirements of engineering and technical personnel for implementing the third five year plan in the principal fields of national development, such as, building & road construction, railways, irrigation and power, development of oil & mineral resources, agricultural engineering, etc.:

(4) to review the existing facilities for practical training in industrial establishments; including apprenticeship and to recommend measures for their expansion in cooperation with units both in the public and private sectors;

(5) to recommend targets for the provision of training facilities for the third five year plan keeping in view the likely requirements for the next 15 years;

(6) to recommend the lines along which detailed programmes for the expansion of technical education should be worked out by Central Ministries and State Governments;

(7) to recommend measures for the provision of adequate teaching personnel in technical training institutions at different levels;

(8) to recommend measures for the full-utilisation of available technical manpower including those employed or under training abroad;

(9) to make such other proposals as may be necessary.

3. The Working Group had three meetings—first on 13th & 14th March, the second on 7th, 8th & 9th June, and the third on 26th December, 1959. The procedure for the meeting was:—

- (a) discussion of papers on different subjects relating to technical education and vocational training by different members;
- (b) discussion of actual data collected by the Secretariat of the Working Group; and
- (c) clearance of different ideas and papers through the Committees of the Working Group appointed at the first meeting.

A list of papers considered by the Working Group and its Committees & Sub-Committees will be found at Appendix—III.

4. At the first meeting of the Group on the 13th and 14th March, 1959 the following Committees were appointed with membership as stated in Appendix-II:—

- (i) Committee on Coordination
- (ii) Committee on Craftsmen Training & Apprenticeship Courses and Technical Education at Secondary Educational Level
- (iii) Committee on Diploma & Degree Courses including Apprenticeship, Practical Training and Part-time Courses
- (iv) Committee on Post-Graduate Studies & Research
- (v) Committee on Estimating Requirements, Wastage, etc.

The Committee on Craftsmen Training etc., had six meetings on 14th March, 25th April, 23rd May, 15th & 16th July, 23rd September 1959 and 15th Feb. 1960. It had two Sub-Committees—

- (a) one to draw up a list of trades both engineering and non-engineering which should be considered for training of craftsmen, and (b) the other for Artisan Training in Rural Areas.

5. The Committee on Diploma and Degree Courses etc. had four meetings on 14th March, 22nd & 23rd April, 8th & 9th June, and 16th July, 1959.

6. The Committee on Post-Graduate Studies & Research held two meetings; one on the 14th March and the second on 24th April 1959. At the second meeting the Chairman explained that on the basis of the recommendation made by the Committee at their meeting on the 14th March regarding appointment of a High-powered Committee on the subject, the question was considered by the Post-Graduate Development Committee of the All India Council for Technical Education on 11th April 1959, and on their further recommendation, the Government decided to appoint an Expert Committee to evaluate the progress of Post-Graduate Courses in engineering and technology at different centres and suggest measures for improvement and further development. In view of this, it was not necessary for the Committee to pursue their work further.

7. The Committee on Estimating Requirements and Wastage had four meetings on 14th March, 27th April, 6th May and 7th June 1959. At the meeting on the 7th June it was decided to appoint a Sub-Committee with Shri R. Prasad, Joint Secretary & Director of Manpower Ministry of Home Affairs, as Chairman, to find out, after discussion, manpower requirements of different Ministries for future development in their respective sectors.

CHAPTER II

TECHNICAL EDUCATION AND PROBLEMS OF MANPOWER

8. That technological development of a nation was essential for survival in modern times became clear soon after the war. The shortages of scientific and technical manpower were felt in almost all industrially advanced countries during the post-war period. In the U.K. the White Paper on Technical Education presented to the Parliament in 1956 expressed the deep anxiety of the British people to make vigorous attempts to increase scientific and technical personnel to bring it at par with the technical marches of the USSR and the U.S.A. and they arrived at a policy of developing Central institutions and technical colleges with large-scale programme involving a capital expenditure of £10 million for five years with a further £2 million for necessary equipment. The Manpower Studies in the U.S.A. indicated a deep awareness of the problem of shortages in various fields and the need to enhance training programmes and to achieve objectives through continuing and many sided efforts sustained by the public opinion to acquire the co-operation of the schools, training institutions, the employers, labour organisations, voluntary groups, the armed forces, and local, State and Federal Governments. The long range objectives for example, suggested in the study "*A Policy for Skilled Manpower*" of the National Manpower Council are listed as follows:

- (1) to strengthen the contribution made by secondary education to the acquisition of skill;
- (2) to develop a more effective programme of vocational guidance;
- (3) to provide more equal opportunities for all individuals to acquire skill;
- (4) to improve the facilities and methods used to train skilled and technical manpower; and
- (5) to increase knowledge about our manpower resources.

9. A number of American studies in regard to Soviet Professional Manpower indicated an emphasis on the same problem. For example, Nicholas Dewitt's Study "*Soviet Professional Manpower—Its Education, Training and Supply*" 1955, pointed out how the availability and growth of specialised manpower resources in the U.S.S.R. have been brought about during the past 25 years through a planned educational effort. In 1953, the Soviet Union had about 500,000 trained professional engineers, while in the U.S.A. there were about 530,000 engineers. In 1957, however, these figures became 637,000 for the U.S.A. and 793,000 for the U.S.S.R. This study has revealed that the number of teachers of all ranks and

at all levels in the educational system is larger in the Soviet Union than in the U.S.A. For example, in 1952, the U.S.S.R. employed 2 million teachers as against 1.4 millions in the U.S.A. in 1953.

10. Further the Russians were determined to train increasingly greater number of scientists and technologists and had announced a target of 50 per cent increase in the number of professional engineers after 1955¹. It has also pointed out that both in salaries and privileges, the careers of scientists and technologists in the U.S.S.R. are made very attractive. "Moreover, there is far larger use of women power in Russia than in other countries; for example, about three-quarters of the medical doctors and one-quarter of the engineers are women"².

11. Besides, the studies in this regard indicate that in 1956, engineers of all categories for 100 thousand population were about 130 in the U.K., 320 in the U.S.A. and 360 in the U.S.S.R. The corresponding figure for India today (1959-60) would be about 20 to 25. It is true that countries like the U.S.A. and U.S.S.R. are producing more than ten times the number of engineering personnel we are producing in relation to the population; but the *per capita* income as well as industrial development is proportionately much higher in those countries and therefore the requirements much greater. The conclusion which we can draw is that if our planned efforts are directed towards increasing national income, and if our industries and agriculture had to develop with greater speed, then scientific and technical personnel must be trained in a much larger proportion. The efforts that we make to catch up with developments in the advanced countries may be limited by our resources for investment, but should not be lacking in vigorous efforts. It is possible to think that during the next 15 years while we make efforts at further development, the western development itself may go much farther on account of the conscious effort they are making towards additional increases in scientific and technical personnel and further research and availability of larger resources. We have to be abreast with these development as well and new scientific knowledge and technological development in other countries have to be broadly integrated with our progress. The problem for us is: with whatever investment we could make, how much more we could achieve.

12. It is really since 1947 that we have started thinking seriously about the problem of scientific and technical manpower in our country. The Scientific Manpower Committee set up by the Government of India in April 1947, under the Chairmanship of late Shri Shanti Swarup Bhatnager was perhaps the first national attempt at assessment of the problem suggesting a programme for the immediate improvement and expansion of facilities for scientific and technical education, research and training. This work was further taken up in the wake of successive national plans for economic development.

1. D. A. Troitsky : Training of Engineers in the USSR, p. 8.

2. British white Paper on "Technical Education" 1956, p. 39.

13. At the time of preparing the Second Five Year Plan, Planning Commission appointed the Engineering Personnel Committee in 1956, which made an attempt to work out a general assessment of shortages of supervisory and higher grades of engineering personnel for implementing the Second Five Year Plan in principal fields of national development, such as, building and road construction, railways, industrial development in public and private sectors, mining and irrigation and power, etc. The Committee's finding was that the demand for engineering personnel far out-stripped the supply and estimated the short supply in 1960-61 to the extent of 1,800 graduates and 8,000 diploma holders in different branches. To meet the shortages they recommended that the existing established institutions should be expanded fully. The minimum programme they recommended was an average increase of 20 per cent in the out-turn of graduates and 25 per cent in the case of diploma holders in the expansion programme of the established institutions. In addition, they recommended during the Second Plan the establishment of 18 Colleges and 62 Diploma Institutions and estimated that the cost of this programme would be in the neighbourhood of Rs. 16 crores. *Inter-alia*, they also made recommendations in respect of recruitment policies, establishment of Technical Manpower Committee of the Cabinet, and a Technical Manpower Division to serve the Cabinet Committee. They further dealt with subject like the quality of engineering personnel, pay and prospects, apprenticeship training, training of craftsmen and the problem of 'flight of personnel'. This was the first attempt at the national level to analyse our manpower problems in the field of technical education though they rightly acknowledged "that a number of attempts at assessing the requirements of engineering personnel in isolated sectors have been recently made in the Ministries at the Centre and in the States".

14. The recommendations of the Engineering Personnel Committee were further considered by the Planning Commission and they appointed a small implementation committee of two members known as the Ghosh-Chandrakant Committee who submitted their report on the 17th January, 1957, on the basis of which development of engineering education both at the degree and diploma levels took place during the second plan. They recommended that 19 existing engineering colleges and 50 polytechnics should be further expanded in larger units capable of yielding 2562 additional seats in degree courses and 4885 in diploma courses. For the rest of the requirements estimated by the Engineering Personnel Committee, 3 new engineering colleges and 23 new polytechnics were recommended for establishment. The new institutions were estimated to yield 520 seats for degree and 4020 seats for diploma courses. The details of the actual development are discussed later. It may, however, be stated that the impact of expansion on the basis of these recommendations could hardly be felt in second plan, but the third plan requirements of technical personnel would, it is noted, on the basis of demand and supply, calculations discussed later, be largely met from the existing institutions which would have a total estimated sanctioned annual intake capacity of 13,500 and 25,000 pupils at

the degree and diploma levels respectively by the end of the second plan.

15. In regard to the implementation of the manpower policy recommended by the Engineering Personnel Committee, it was considered essential to have (a) an effective and continuous collection of the necessary information; (b) the framing of policy on the basis of information so collected; and (c) execution of such a policy. One step in the direction was to improve co-ordination among the different agencies concerned in this field both at the Centre and States. Arrangements that existed, for example, in the Ministry of Scientific Research and Cultural Affairs, Ministry of Labour and Employment, Ministry of Commerce and Industry, Planning Commission, etc., for the collection and processing of information on the demand and supply of manpower needed coordination and scrutiny. It was decided by the Government of India in September 1956, to establish a Directorate of Manpower and locate it in the Ministry of Home Affairs, which started functioning from November, 1956. It provided the Secretariat for the Cabinet Committee on Manpower and was concerned generally with the co-ordination of manpower policies and programmes while the implementation of the programmes was done by the Ministries and other agencies concerned. This Directorate works in close collaboration with the Divisions of the Planning Commission dealing with manpower and the Council of Scientific and Industrial Research and maintains liaison with the Ministries at the Centre through officers nominated by them to deal with their manpower problems. The Manpower Directorate also co-ordinates the work done in the States: each State has appointed a Manpower Officer to look after the work in that State and keep the Directorate informed of developments. This organisation has contributed considerably towards implementation of the Engineering Personnel Committee's recommendation and helped in planning for the training personnel in advance for projects that would be or were likely to be established during the future plan periods. Besides this, in the light of the manpower studies undertaken by the Perspective Planning Division of the Planning Commission, the Directorate has been able to alert the Ministries and State Governments in regard to advance training arrangements for training personnel required for schemes of development in the fields of industry, steel and mines, irrigation and power, education and social services, agriculture, etc.

16. Another significant factor is that studies in respect of manpower have been taken up by different advanced countries particularly in recent years. The National Manpower Council was established at Columbia University, U.S.A. in September, 1951, under a grant from the Ford Foundation to study important manpower problems in what they described as a period of emergency and to contribute to the improved development and use of country's manpower resources. The Council's primary concern is with the training skills, capacities, competence and creativeness of the American people, that is, with the quality of manpower resources. It is composed of a group of leaders on industry, labour, education and public service from all sections of the country. The studies of this Council which started being available since 1952, include, "Students Defect

ment and National Manpower Policy" (April 1952), "A Policy of Scientific and Professional Manpower (1954)", "A Policy for skilled Manpower (1954)" etc.

17. In all countries with highly developed economy, efforts have been made in post-war years to forecast development and consumption, and values of income and prices. Statistics are compiled showing the growth of population, productivity, and other major factors. Similar efforts are now being extended to professional classes, such as engineers, since a shortage of manpower would result in serious bottlenecks in the national economy. In a recent study* done by Mr. Harold Goldstein, different methods to forecast demand and supply have been discussed and suggestions made. After a survey of methods employed in different countries it has been stated that no single general method can be recommended for all the countries to follow. "The countries differ in purpose for which they make forecasts, in the kinds of task of statistical data they have available, the components of demand and supply which are quantitatively significant enough to be worth measuring, in the characteristic of their economic development and ways of using scientists and engineers and in the resources they can put into research in this field". Further since most of the forecasts have been made recently it is too early to apply the test of accuracy to the methods followed and to reach a judgement as to the best methods. Some of these problems have been illustrated by the methods employed in Chapter VI—Demand and Supply.

18. A number of studies done recently in regard to manpower requirements indicate that the continuing technical development towards ever-growing complexity, towards increased speed in production and operation and refinement of automatic regulation and control of plant and machinery, causes a shift from manual towards mental work. This certainly involves a steadily increasing demand for engineers. The Working Group, therefore, recommended that while making an estimate for the requirement of personnel for the fourth plan that will be trained during the third, a sufficient margin should be kept for training more rather than less. And while it is difficult to estimate the shape of industrial programme in the fourth plan, the experience of the second plan may be taken as an index of the need for trained personnel of higher qualification in every industry under the different categories discussed earlier. It has been for example, pointed out that the electrical industry which is bound to develop in the third and the fourth plans as more power is produced, will take keen interest in the supply of trained engineers who shall be qualitatively and quantitatively adequate. A study** of the relationship between power generation and national income per head in forty countries indicates that power and electrical industry bring with them a rise in living standards. These countries it was observed, can be grouped under three broad categories as:

- (1) Industrially developed countries with high living standard (annual *per capita* energy consumption 2,400

*Methods of Forecasting Demand for and Supply of Scientists and Engineers by Harold Goldstein, June 1958—A Report for Scientific and Technical Personnel Programme of Governing Committee on Scientific and Technical Personnel of the Organisation for European Economic Cooperation.

**Energy, Production and Utilisation, 1959, by Prof. M. S. Thacker, page 32.

therms, national *per capita* income Rs. 6,000 and over per annum).

- (2) Moderately developed countries (annual *per capita* consumption of 300 to 600 therms, national *per capita* income of the order of Rs. 2,000 per annum).
- (3) Less developed countries (annual *per capita* consumption 100 therms, national *per capita* income less than Rs. 500 per annum).

India comes under the third category with the *per capita* income of Rs. 280 and annual *per capita* energy consumption of about 90 therms. Power, therefore, seems to be the key to industrialisation and therefore with its development the demand for technical personnel increases. Actually, it is a chain reaction, because increase in power brings in development of industries and higher national income and greater consumption of goods resulting in larger production of goods requiring qualitatively and quantitatively larger number of technical personnel at all levels. The electrical industry, it has been said, requires more engineers for every thousand of its employees than the average for industry as a whole. For instance, in the U.S.A. industry as a whole at present requires 20 engineers for 1,000 employees, while the figure in electric industry is 80 engineers for 1,000 employees. A similar ratio is applicable to the German electrical industry. Thus during the Third and Fourth Plans when the emphasis is going to be on the development of power, the need for engineers will be in a larger proportion than hitherto and efforts should be made, as is done in the U.S.S.R., to proper and adequate planning of the educational system to produce a larger number of scientists and technical personnel in the years to come.

CHAPTER III

THE CONCEPT OF TECHNICAL EDUCATION IN A NATIONAL SYSTEM OF EDUCATION.

19. The historical position of technical education including training in India has been traced in different documents, but a starting point could be made with the report on "Vocational Education in India" by A. Abbot and S. H. Wood-1937, and the Sargent Report, 1944. The other important documents are the University Education Commission Report, 1949, the Secondary Education Commission Report, 1953, Reports of the Advisory Committee on Technical Training, 1944-45, Shivarao Committee Report, 1952, Report of the Technical Training Committee of the Small Scale Industries Board (Advani Committee), 1957 and the Report of the Apprentice Training Committee of the Small Scale Industries Board, 1957-58. Apart from these documents which deal with Technical Education at the school and higher levels and vocational training in institutes and industry, the problem of technical personnel has been recently studied in: (1) Scientific Manpower Committee 1949, (2) Report of the River Valley Projects Technical Personnel Committee 1956, (3) Report of the Engineering Personnel Committee 1956, and (4) Report of the Agricultural Personnel Committee, 1958. The Manpower Studies of the Perspective Planning Division of the Planning Commission and Employment and Unemployment Studies of the Directorate General of Resettlement and Employment, Ministry of Labour & Employment, are some of the latest documents helpful in this direction.*

Concept of Technical Education & Vocational Training.

20. Dealing first with the question of concept of Technical Education and vocational training, a reference may be made to the Chapter on Technical, Commercial and Art Education in the Sargent Report which stated the problem adequately. It was pointed out how the Spens Report** in advocating the need for the widest variety of curriculum for children at the High School stage introduced the concept of Technical High Schools and emphasised the cultural and vocational value of this new type of school. Also, as the Sargent Report*** stated, the conception and the function of Technical Education as regards both its aims and contents had been considerably enlarged in Western countries during recent years. Consequently, it was important to emphasise from the outset that any scheme of development of technical education as an integral part of a national system must have a two-fold character. It must both form a link between education and industry and it must, at the same time, receive quite separate consideration as a form of mental training which is especially suited to certain types of intelligence

*These are included in the bibliography at the end.

**Report of the Consultative Committee on Secondary Education with special reference to Grammar Schools and Technical High Schools, 1938.

***Sargent Report, 1944, page 29.

irrespective of their future occupations. To quote the Sargent Report: "the primary function of technical instruction remains and is likely to remain that of satisfying the needs of industry and commerce for (a) skilled craftsmen, (b) intelligent foremen and executives and (c) research workers. In Western countries, however, of late years the content of technical education has been steadily widening, due on the one hand to increased demands on the part of industry, created not only by accentuated competition but also by the emergence of entirely new industries and on the other hand, to somewhat tardy recognition on the part of those responsible, that technical education, if it is to be really fertile, should include the study of design and distribution as well as the actual processes of manufacture."

21. It therefore becomes clear that the type of education and training changes its concept or curricular courses according to the requirements of a developing industry and commerce. But confining its scope to their requirements, it is to be recognised that technical education is part of a national system of education and commences along with the general process of education. As early as 1895 the Royal Commission on Secondary Education in the U.K. described its general ideas thus: "All education is development and discipline of faculty by the communication of knowledge, and whether the faculty be the eye and hand, or the reason and imagination, and whether the knowledge be of nature or art, of science or literature, if the knowledge be so communicated as to evoke an exercise and discipline faculty, the process is rightly termed education". Thus, no definition of technical education at the school level is possible that does not bring it under the head of secondary education, nor can secondary education be so defined as absolutely to exclude from it the idea of Technical Instruction.*

22. All the world over, particularly since 1950, it has been recognised that technological advance is necessary for any economic development in the increasingly complex industrial and social organisation towards which modern society has been moving. This involves a technological and scientific leadership and employs a social foresight which will appreciate the occupational trends guiding the provision of technical and scientific education. Seen in this perspective the effect of changes in education and technology becomes clearer. As long as a nation educates only a small proportion of its children the instruction given could be only of a special or liberal kind for men who on account of their means were able to get an exclusive and costly liberal education. But when a nation decides to take to school almost all its young people upto the age of 14, it is most important that education given in later years should be appropriate. Otherwise, large numbers may be prepared for a type of life which they will not be able to lead. Thus, we are moving from the "pupil-Centred" type of education towards "community-structured" educational system that is so designed as to take due account of the means by which a nation exists and prospers. Facilities for Vocational Training on a large scale here will have their significant function. During the life-time of the young children for whom we are making elementary education free and compulsory

*Sargent Report, 1944, page 35.

the spread of technology in this country will have changed the very values and ways of living. The pattern of education and training that the new society would demand will undergo changes which wise men must foresee. This was realised even by such a technically-advanced countries like the U.K., who in their White Paper on Technical Education (1956) said "the aims are to strengthen the foundations of our economy to improve the standards of living of our people and to discharge efficiently our many-fold responsibilities overseas". Behind this objective would be the scientific and technological advancement that the nation must undertake. The whole concept of the content of education from the lowest level is undergoing change in countries like the U.S.A., U.K., U.S.S.R., etc. and we have to recognise it. In relation to the changes in social patterns, our definition of culture is perhaps also undergoing a change. It is assuming more and more bias for scientific knowledge and recognising this the Government of India stated in their Scientific Policy Resolution of 4th March 1958* that "the key to national prosperity apart from the spirit of the people lies, in the modern age in the effective combination of three factors—technology, raw materials, and capital, of which the first is perhaps the most important since the creation and adoption of new scientific techniques can, in fact make up for a deficiency in natural resources and reduce demands on capital. But technology can only grow out of the study of science and its application". The Scientific Policy Resolution further pointed out that the dominant feature of the contemporary world is the intense cultivation of science on a large scale and its application to meet a country's requirements. The aims of the scientific policy as set out in the resolution were (1) to foster, promote and sustain by all appropriate means the cultivation of science and scientific research in all its aspects, pure applied and educational, and (2) to ensure an adequate supply within the country of research scientists of the highest quality and to recognise their work as an important component of the strength of the nation."

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23. It will be thus clear that the basis of technical education has to be built up from the school stage by emphasising courses in Science, Mathematics certain crafts and bias for practical work. It has been pointed out that in Russia the scientific education in high school stage is broad-based and fostered with the greatest zeal. At every such school they have in the top four classes of the 10-year school, the provision for training in scientific subjects with special emphasis on physics, mathematics, and mechanics.** Recognising this, in a recommendation made by the Panel on Education of the Planning Commission at their second meeting held at Poona on 15th and 16th July 1957, it was stated that "in view of the fact that requirements for technical personnel at all levels will increase with the increased tempo of industrial and agricultural development of the country and also in view of the fact that secondary education should provide an adequate preparation for life for a majority of the

*See Appendix IV.

**See also Dewitt, Soviet Professional Manpower, 1955 pp. 33-34. Concept of Technical Education & Vocational Training.

students, it is recommended that vocational and technical education be promoted in appropriate schools in adequate numbers at the middle school and post-middle stage.....”

24. While the introduction of scientific and technical bias in our elementary and secondary schools as well as in the universities and colleges would be a step in the right direction for the implementation of the Scientific Policy Resolution of the Government of India, it will be proper for us as a Working Group to recommend that for the advance of technical and technological education and training at different levels appropriate action be taken by State Governments and the Central Government to emphasise in the curricular courses of elementary, and secondary schools, the importance of scientific courses and the use of tools and instruments that would train the hand and eye of pupils at the appropriate stage of development.



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CHAPTER IV

SCOPE OF TECHNICAL EDUCATION AND VOCATIONAL TRAINING

SECTION I

Types of Institutions

25. It has been stated earlier that scientific or technical education must commence at the appropriate levels in the school stage with due regard to the requirements of the community or the nation as a whole. Some of the objectives and functions have been recognised in the educational system for more than a century since the early establishment of engineering colleges at Roorkee, Sibpur (West Bengal), Guindy (Madras) and Poona. Side by side, certain industrial and technical or engineering schools were established in many States. All these have developed into a pattern of technical education, which has been guided by the advice of special Committees appointed by the State and the Central Governments at different stages of development. These Committees took stock of the educational and training institutions and reviewed and revised ideas about the requirements of the institutions, teachers and students and the courses of training in the context of our industrial and economic progress. The different types of institutions which have come to be established to-day both as a historical development of the past and as our planned effort may be listed as follows:

(a) *Secondary Education:*

- (i) Technical High Schools on the pattern recommended in the Sargent Report, 1944.
- (ii) Junior Technical Schools according to the scheme of the Ministry of S.R. & C.A., 1957.
- (iii) Technical stream in Multi-purpose Schools as recommended by the Secondary Education Commission, 1953.

(b) *Vocational Training:*

- (i) Industrial Training Institutes sponsored by the Ministry of Labour & Employment including evening classes for industrial workers.
- (ii) Production-cum-Training Centres and Trade Schools.
- (iii) Training Centres for Rural Artisans, Small Scale Industries and Training Centres under the different Boards of the Ministry of Commerce & Industry.

(c) *Diploma Level:*

Polytechnics, Engineering Schools and other institutions offering courses for National Certificate or State Diploma.

(d) *Degree Level and above:*

Engineering Colleges, University Departments of Engineering and Technology, Higher Technological Institutes, etc.

(e) *Special Institutions* established by some Government Departments and industry.

26. These are explained in the following paragraphs:

(a) *Secondary Education*:

(i) *Technical High Schools* :

27. On the recommendation of the Abbot-Wood Report the Delhi Polytechnic was established in 1941, which offered, among other things, technical course at the Higher Secondary level. The importance of the establishment of technical high schools as distinct from the academic type of schools was emphasised in the Spens Report, 1939 and was recommended for establishment in this country by the Sargent Report, 1944. In the light of these recommendations the State Governments considered the establishment of Technical High Schools. In Bombay Province, for example, the Industrial and Technical Secondary Education Committee was set up in 1949* to consider this problem. They emphasised the need for establishment of such schools particularly in urban areas where the number of students attending the High School classes was more than 2,000. It was also recommended by the Committee that such schools at the post-middle stage should be started in industrial towns and private high schools should be encouraged by grants-in-aid for conversion into the Technical High Schools. The present pattern of Technical High School in the Bombay State is a further development of this recommendation and that of the Secondary Education Commission who in order to popularise these schools and to economise in building and equipment also recommended that central workshop may be established to cater to the needs of all the technical subjects, like geometrical and machine drawing, workshop technology, elements of electrical and mechanical engineering and allowing two or more schools to send their students at the secondary stage to take part in the training.** According to the present pattern in Bombay, the same central workshop is also used for a number of industrial training courses for students who have no special aptitude for academic studies or who want to make a living as early as possible

28. Similar Technical High Schools were established in some other States, generally conforming to the pattern laid down by the Sargent Report.

(ii) *Junior Technical Schools* :

29. The Junior Technical School, according to the report of Abbot and Wood, aims at giving a boy such a realistic pre-apprenticeship training that when he enters a branch of industry in which machinery is made or used or indeed, almost any branch dependent on the application of science to industrial practice, he rapidly becomes a skilful and reliable workman. The school was meant for those entering organised industries of the manipulative kind such as certain branches of mechanical engineering, textiles and mining.

* Report of the Industrial and Technical Secondary Education Committee, Bombay Govt., 1949, p. 68, para 5.14.

** "General Information about Technical High Schools"—Department of Technical Education, Bombay.

A scheme for Junior Technical Schools was prepared in 1957 by the then Ministry of Education and Scientific Research with a double objective of providing diversification of educational opportunities at the post-middle stage and at the same time imparting training which would enable the students to enter industries either as workers or apprentices. The duration of the course is for three years with a pass in Class VIII as the minimum educational qualification for admission. The scheme has been recommended to the State Governments recently and the progress of the scheme has to be watched and evaluated. It is expected that about 25 schools would be started during the Second Five Year Plan.

(iii) *Technical Stream in Multi-purpose Schools :*

30. The Secondary Education Commission which considered, *inter-alia**, the role of Technical Education at different levels with particular reference to the needs of industries for technical personnel and the problems of education at the secondary education level, recommended that the technical stream in a multi-purpose school should offer instruction in such technical subjects like applied mathematics, geometrical drawing, elements of workshop technology and elements of electrical and mechanical engineering in addition to the core subjects of languages, science, mathematics and social studies. It was clearly pointed out that the technical stream or the technical high school does not produce artisans. The idea was that on completion of Higher Secondary Course in technical subjects, the student would be better equipped than one from the purely academic type of school to pursue studies in a polytechnic or to enter some gainful employment in the industry after a period of apprenticeship training.** The scheme for the conversion of high/higher secondary schools into the multi-purpose schools with technical streams and the establishment of new multi-purpose schools has been initiated during the First Five Year Plan and its progress needs to be evaluated.

(b) *Vocational Training:*

(i) *Craftsmen Training Centres/industrial training Institutes sponsored by the Ministry of Labour and Employment:*

31. The Industrial Training Institutes operated through the Directorate General of Resettlement and Employment of the Ministry of Labour and Employment (DGRE) are perhaps the only Institutes, apart from the special centres under the Ministries of Defence, Railways, etc. for a similar purpose, that are providing currently an extensive training programme for the engineering and non-engineering trades. They were first established during the Second World War to train craftsmen to meet the needs for defence activities. Following the war they were used as Ex-servicemen Training Centres. When the post-war rehabilitation work was completed, the institutes continued as training centres to prepare technicians and craftsmen for industry and to provide training for displaced persons following the partition of the country. In March 1944, an Advisory Committee on Technical Training was constituted by the Govern-

* Report of the Secondary Education Commission, 1953, pp. 39-49.

** Report of the Secondary Education Commission, 1953, pp. 43-46.

ment of India to review the work of the war-time technical training scheme and to recommend measures for adapting it to meet peace-time requirements. While holding the view that the best way of ensuring a regular supply of skilled craftsmen to industry was through a comprehensive and a systematic course of apprenticeship, the Committee felt that the workshop in India was not usually a very good school for obtaining knowledge of first-rate workshop practice and, therefore, recommended that apprenticeship in industry should follow a course of training in specially designed training centres. Therefore, the Committee recommended a scheme for training of young persons as craftsmen to be planned and organised on a national basis with the provision for a national certificate of craftsmanship. Some of the important recommendations of the Committee were as follows:

- (a) The duration of training should be $3\frac{1}{2}$ years of which the first two years should be spent in a training centre and the balance as an apprentice in a factory.
- (b) The age limit for admission to the training centre should be from 14 to 18 years.
- (c) Boys admitted to training centres should have studied upto a standard two years below matriculation or its equivalent.
- (d) As a first essential measure for the implementation of the scheme for the training of craftsmen, arrangements should be made for the training of instructors.

32. The report of the Committee was considered and endorsed by the All India Council for Technical Education and also by the Scientific Manpower Committee. The scheme, however, could not be implemented as the war had by then taken a favourable turn and *ad-hoc* arrangements had to be made for training of the demobilised personnel. The scheme for the training of young persons as recommended by the Advisory Committee on Technical Training was considered by the Government of India in 1947; but was not pursued because all State Governments had not agreed to participate. In October 1948, the D.G.R.E. proposed that the scheme be modified so to provide the training on the same lines as for Ex-servicemen but confined to adult civilians instead of younger persons. The Shiva Rao Committee on the training and employment services organisation of the Ministry of Labour studied this problem in detail and recommended* that the training facilities provided in the centres run by the D.G.R.E. should be integrated with similar facilities provided by the State Governments, the administration responsible for the D.G.R.E. scheme being also transferred to State Governments @. Having regard to the importance of training they also urged that substantial expansion and improvement should be made possible in training centres. It was recommended** that "it should be the responsibility of the Central Government to lay down the policy of training craftsmen, to promote the development of training facilities with due regard to needs and to coordinate the overall training programme throughout the country".

*Shiva Rao Committee Report, 1952, para. 442.

@*Ibid*, para 449.

***Ibid*, para 451.

33. Accordingly, the National Council for Training in Vocational Trades was established in 1956 in the Ministry of Labour & Employment for the purpose of laying down the policy, the standards and the organisation to be built up for the training of craftsmen for industry. It has representatives from the Central Government, the State Governments, Labour, Employers and other interests. The National Council works through the State Councils in each of the States to implement the policy laid down for the purpose. The D.G.R.E. has been made responsible for the implementation of the policy of the National Council and is concerned with the training of tradesmen and to meet the needs of industries. This they have done in the Second Plan through establishment of Industrial Training Institutions in the States with Central assistance of 60% for the programme. In addition, a certain number of industrial training centres were started in conjunction with already established industrial schools or other Technical Training Institutions. In order to provide the adequate number of suitably qualified instructors to give instructions in these institutes, 2 Central Training Institutes for instructors have been started, one at Koni—Bilaspur, subsequently to be transferred to Calcutta and the other at Aundh—Poona to be transferred to Bombay. Four more similar institutions are likely to be set up during the current Plan period. These Training Institutes also serve the needs of industry which have their own training arrangements and programme for training craftsmen.

34. After the completion of the course of training in the Industrial Training Institutes/Centres, an examination is held for which test-papers are set on an all-India basis by the D.G.R.E. and a certificate of the National Council for training in Vocational Trades is awarded to candidates who satisfactorily pass the examination. The minimum entrance qualification for these courses is normally two standards less than Matriculation, though for certain trades Matriculation is required. The period of training for technical trades is 18 months in the institution followed by 6 months in-plant training in industry. For trades other than engineering, only institutional training of 12 months is given. In the Central Training Institutes, for instructors, training for a period of 5½ months is given to trained craftsmen who have already a background of service in the trade with a view to making them instructors. In the training of the instructors emphasis is laid on the principles of teaching and an industrial training institute is attached to Central Training Institutes, so that the instructor trainees could obtain practical experience of actual instruction to craftsmen.

35. Under the craftsmen training schemes of the D.G.R. & E. evening classes are arranged for industrial workers in towns of industrial concentration where the workers could get instruction in the theory of their trades.

(ii) *Production-cum-Training Centre and Trade Schools:*

36. It was noted that the Working Group on Small Scale Industries has considered these institutions and recommended that although the Directorate General of Resettlement and Employment is arranging training in several trades, special training programmes would need to be organised by the State Directorates of Industries in the trades

not covered by the D.G.R.E. The production-cum-Training Centres, which the State Governments had been running hitherto during the Second Plan period have not produced satisfactory results. Accordingly, it was recommended that these should be re-organised completely either purely as Training Centres, where production would only be incidental to training or purely as Production Centres which would be run on a commercial basis. They had further recommended that during the Third Plan, on an average, 5 Training Centres properly equipped may be run in each State and the standards laid down by the National Council for Training in Vocational Trades should be followed. These Centres may be affiliated to this Council to enable the trainees to obtain the Trade Certificates issued by the Council. Practical Training for the Artisans going out from these re-organised Training Centres could be arranged in regular factories or in the Production Centres mentioned above. These production centres may also be utilised for imparting advanced training to artisans in the improved techniques of production.

(iii) Rural Artisan Centres

37. For running training schemes for the benefit of artisans in the Community Development Blocks, the State Governments have been running a number of training Centres. It is estimated that not less than 3,000 centres have been started in about 2,400 C.D. Blocks during the Second Plan. These centres may be grouped under the following broad categories:

1. Training-cum-production centres
2. Institutional Training Centres.
3. Peripatetic Training Centres.

It is, however, understood that the schemes have to be further re-organised on sound lines so that they could prove more effective and purposeful in accordance with the Development Commissioners' Conference at Mussoorie, 1957. It was felt that it would be better to have a smaller number of better-equipped and well-manned institutions to cater to the needs of artisans in rural areas. The Ministry of Community Development and Cooperation have appointed a Committee to examine the training programmes of rural artisans with a view to re-organising the training-cum-production centres in the C.D. Blocks.

(c) Diploma level—Polytechnics

38. It was pointed out by Abbot that some recruits to industries and commerce as well as to certain professional occupations enter upon their specialised work at comparatively late ages and it is for these that the Senior Vocational Schools could provide a suitable training. He suggested** that like the Junior Vocational (Technical) Schools these should refrain from attempting to give an apprenticeship course, this task being left to the existing industrial schools carried on in various States. The function of Senior Vocational Schools was to lay down for their pupils "that firm foundation on

**Abbot-Wood Report para 60.

which apprenticeship (or its equivalent professional pupilage) can be built and not to serve as substitutes for workshop or office experience”.

39. It is this senior vocational school that has developed into the polytechnics. The courses were directed to prepare students either for employment or for further training in an industrial school. Whereas the Senior Vocational School was also to serve the needs of persons already in employment by conducting a variety of part-time classes, thus constituting what has come to be known as a “Polytechnic Institution”. These institutions have been developed in all parts of the country mostly for offering 3 years diploma courses in such branches which are of immediate use in the industry and Government Departments, namely civil, electrical and mechanical engineering. The introduction of specialised course at this level, in Mining Engineering for example, is only a very recent development.

40. In addition to these institutions, on the recommendation of the All India Council for Technical Education, a scheme for sandwich courses for the National Certificate in Mechanical Engineering was prepared during the Second Five Year Plan. Two such courses have been started in Calcutta and Madras.

(d) Degree level and above

41. The Engineering Colleges, the University Departments of Engineering and Technology as well as the Higher Technological Institutes provide courses for which entrance qualification is a pass at the Intermediate Science or the Higher Secondary examinations. The field of engineering education at this level was surveyed by the University Education Commission, 1949, and the developments since then have been generally in the direction of increase in the number of such institutions besides the establishment of the Indian Institutes of Technology at Kharagpur, Bombay, Madras and Kanpur. At the post-graduate level facilities are available at the Institutes like the Indian Institute of Science, Bangalore, the Engineering University at Roorkee and the Indian Institutes of Technology and a few selected Engineering Colleges and university departments approved by the All India Council for Technical Education.

42. The Post-graduate Development Committee of the All-India Council for Technical Education has defined the nature and scope of development in Engineering/Technology at post-graduate level to envisage the following aspects:

1. Post-graduate courses of one year or 1½ years duration leading to the award of the Master's degree in Engineering/Technology or equivalent award.

2. Research training—Research Departments should be developed in engineering/technological institutions so as to give an impetus to the training of research-minded engineers. Whereas, hardly any facilities in this respect existed before 1947, today the All India Council for Technical Education has recommended 77 post-graduates Courses organised in 21 institutions in the country for 500 students

taking advantage of the courses. Detailed estimates have been worked out by this Committee for most of these courses: Rs. 88.7 lakhs have been approved for non-recurring items and Rs. 13.7 lakhs per year as recurring cost to University and non-University institutions for running 50 Courses other than those sanctioned at the Indian Institute of Technology, Kharagpur. It may be added that from 1958-59 onwards the entire expenditure on the post-graduate courses is being met by the Central Government. The whole question of further development of the programme is now under the consideration of the Committee appointed by the Government of India for the purpose.

(e) Special Institutes established by the Government Departments and Industries.

43. There are a few institutes run by the Government Departments like the Railways, Defence and the Post & Telegraph, who generally train Engineers and Technicians required for their own personnel needs.

SECTION II

Types of Personnel required

44. Classification of engineers and technicians has become a complicated problem, because technical training has become so diversified as well as highly specialised in certain branches in recent times. The vocational training required for industrial occupations assumed a greater significance in India during war and since then has covered larger areas, such as, craftsmen, foremen, artisans including rural artisans, in different industries and crafts. This class includes engineering aides, science aides, such as, drafting specialists and laboratory assistants, technical specialists, such as certain types of inspectors, technical production and maintenance supervisors, semi-technical men, such as technical salesmen or factory accountants who need technical training in addition to that of some other type. The study "Occupational pattern in Manufacturing Industries in India, 1956" brought out the different occupations in the several industry-groups. The training required is for analysts, computers, designers, draughtsmen, inspectors, laboratory technicians, process technicians, technical assistants, technical salesmen, testers, etc. for different industries like Automobile and aircrafts manufacturing, air transportation, building construction, communications equipment manufacturing, electric power and power production and distribution, hydro-electric development, industrial chemistry, iron and steel production, lumbering and wood processing, machine tool manufacturing, metal mining, metal products manufacturing, oil refining, petroleum production, pulp and paper manufacturing and telephone communication, textile and garment manufacturing, to mention only a few of the important industries. It is evident that the requirement of this type of skilled worker is of a wide dimension in quality and quantity and details and the way in which training has been provided mostly through institutions are mentioned in Section I of this Chapter.

45. The second category of technical personnel is in relation to the technical assistants, supervisors, design-draftsmen, overseers etc. who are trained at present in the polytechnics. The technicums in the USSR, the Technical Colleges awarding their own diplomas or preparing students for the higher national certificate in the U.K., and the technical institutes in the U.S.A. could perhaps be compared to our polytechnics. However, a further study is necessary to know whether our training programmes in relation to our requirements serve the same purpose as that served by the foreign institutions of a similar kind.

46. The third category of personnel required is that of engineers in the various branches of engineering and technology, for production, operation, maintenance and sales, who are generally trained in the institutions at graduate level and above. In addition, are the requirements for design and development engineers, research men, scientist-engineers and senior administrators and executives. The basic qualification for each category would generally be a degree in engineering or equivalent professional qualification. In certain cases experience in the field of industry or research would be considered necessary. In case of senior administrators and executives a combination of practical knowledge of finance, business administration and planning with technical knowledge would be desirable. While basic education and research qualification would be what our institutions would impart, practical experience of varied and intensive kind would be the best teacher for these categories of personnel.

47. In the last place, though not as a separate category, the most important personnel for any programme of technical education and vocational training is the well-trained and experienced teachers at different levels of training to staff the various institutions right up from the trade school to the highly advanced research institute. The shortages and requirements of this type are discussed in Chapter IX.

48. It is recognised that the industrial and technological development may change the nature of training emphasising certain aspects and bringing into the course of training a larger area and very often a more intensive training in more specialised fields which may change the very nature of institutions established during the past few years. In shaping the future development of our advanced courses and research, we will be guided to a large extent by what is happening in advanced countries in the various fields of application of science and engineering. At the level of diploma education and certificate for craftsmen training, we may have to re-think and re-organise methods of training as well as institutions. For, the institutions which we have established might have, in the long run, to undergo such changes as may be required in relation to the big economic development planned during the next 15 years.

49. The Working Group recommends that appropriate bodies like the All India Council for Technical Education, the Ministry of Education, Ministry of Scientific Research and Cultural Affairs, Ministry of Labour and Employment and the Planning Commission consider this problem with a view to seeing that coordination of efforts

is done by different agencies for producing appropriate personnel and secondly, adequate training is provided in different institutions with a view to bringing about a dynamic relationship between the out-turn of the institutions and the requirements of industries and other economic activities both qualitative and quantitative. It is recognised that technical training at different levels involves heavy cost to the nation and any steps taken to eliminate wastage and to introduce measures of economy would be regarded as important aspects of planning. The appropriate bodies mentioned above should, therefore, review the position of training facilities in a coordinated way from time to time and assess and make suggestions for new developments through Committees appointed for the purpose.



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CHAPTER V PRESENT POSITION

I. ENGINEERING COLLEGES AND POLYTECHNICS

50. As a result of the steps taken on the recommendations of the Scientific Manpower Committee (1947) and the progress achieved during the first two plans, there has been a steady increase in the number of engineering Colleges and Polytechnics in the country as indicated in the table below:

TABLE NO. 1

Expansion of facilities for technical education in Engineering Colleges and Polytechnics (for institution-wise intake see Appendix VIA and VIB).

Year	Engg. & Technology Colleges			Polytechnics, Engg. & Technological courses		
	No. of Institutions	Annual @ intake	Outturn	No. of Institutions	Annual intake	Outturn†
I	2	3	4	5	6	7
1950 . . .	49	4119	2198	86	5903	2478
1951 . . .	53	4788	2693	89	6216	2626
1952 . . .	56	5184	2956	90	6499	2654
1953 . . .	58	5450	2880	92	7213	2747
1954 . . .	59	5468	3207	95	8313	3397
1955 . . .	64	5937	4017	102	9397	4072
1956 . . .	74	6632	4293	111	10242	4075
1957 . . .	74	9778	4290	129	15995	5034
1958 . . .	83	11086	4665	157	19332	6345
1959* . . .	86	11432	4750	166	21097	9900
1960* . . .	97	13497	5310	197	25597	10397

51. Development expenditure on education and technical education in the first two Plans is as shown in the following table:

*Estimated.

† Outturn in a particular year may be related roughly to intake figure that precedes by four years in the case of colleges and three years in the case of polytechnics.

TABLE NO. 2

Development expenditure on Education and Technical Education during the First and Second Plan periods.

(Rs. in crores)

Year	Development expenditure on Education	Development expenditure on Technical Education	Col. 3 as percent age of Col. 2
I	2	3	4
1951-52	19.8	3.7	18.7
1952-53	22.4	3.9	17.4
1953-54	26.6	4.3	16.2
1954-55	37.3	3.9	10.5
1955-56	46.8	4.4	9.4
Total expenditure .	152.9	20.2	13.2
1951-56 (I Plan Provision)	169.00	23.0	13.6
1956-57	23.94	5.92	24.7
1957-58	35.56	7.30	20.5
1958-59	49.50	9.48	19.2
1959-60	76.39	17.28	22.6
1960-61	86.07	20.75	24.1
1956-61 (Total estimated expenditure)	271.46	60.73	22.4
1956-61 (II Plan Provision)	275.0	56.0	20.4

1. *First Plan:*

Analysis of development (1951-56).

52. Out of a total outlay of Rs. 169 crores for Education in the first plan, the provision for Technical Education was Rs. 23 crores—Rs. 14 crores at the Centre and Rs. 9 crores in the States. The actual expenditure out of Rs. 153 crores for Education in the First Plan was Rs. 20.2 crores for Technical Education—Rs. 11.49 crores at the Centre and Rs. 8.71 crores in the States.

53. During the first plan the Indian Institute of Technology, Kharagpur, was established as the first in a chain of 4 such institutions proposed to be started on the basis of the Sarkar Committee Report. The scheme to provide research training scholarships and stipends for practical training, the schemes for promotion of scientific and technical education and research and the development and improvement of 14 selected Non-Government colleges were brought into the plan and continued.

The expansion programme of the Indian Institute of Science, Bangalore, was continued for studies and research in aeronautical

engineering, power engineering, internal combustion engineering, metallurgy and electrical communications engineering with an estimated expenditure of Rs. 78 lakhs during the first plan period. Under the scheme of practical stipends to selected students, places were secured in 160 private industrial concerns and six Government organisations for 6,045 graduates and 277 diploma-holders. Under the scheme "Research Training Scholarships", 314 senior scholarships and 237 junior scholarships were provided against the target of 350 and 200 respectively. The Indian Institute of Technology, Kharagpur, the V.J.T.I. Bombay and the Indian Institute of Science, Bangalore, were selected for organising post-graduate courses in industrial engineering, and industrial administration. The All India Institute of Social Welfare and Business Management, Calcutta, Delhi School of Economics, the Business Management section of the Department of Economics of the University of Bombay and the Department of Business Administration of the University of Madras were selected for post-graduate courses in business management. Preliminary steps were also taken for providing facilities for the specialised courses in printing technology and for establishing School of Town and Country Planning in Delhi in association with the Institute of Town Planners (India). Interest-free loans were also sanctioned for providing hostel facilities for students in the different technical institutions.

2. *Second Plan: Analysis of development (1951-61):*

54. In the Second Plan out of a total provision of Rs. 275 crores, the provision for technical education was Rs. 52 crores in addition to Rs. 4 crores included for the programmes of Technical Education under the University Grants Commission. However, it is expected that the total expenditure on Technical Education programmes in the Second plan may amount to about Rs. 60-73 crores.

55. Among the programmes, the Indian Institute of Technology, Kharagpur, was developed with a plan provision of Rs. 2.50 crores, likely to be revised to Rs. 3.34 crores. The institute had, in 1958-59, a student population of 1634; under graduates 1449, post-graduates 141, research students 43 and post-doctor fellow 1. This institution was declared to be one of national importance by an Act of the Parliament on 1-4-1957. The Indian Institute of Technology, Bombay, started functioning in July, 1958, with a plan provision of Rs. 3.25 crores and assistance from the U.S.S.R. through the UNESCO and a bilateral agreement between India and the USSR. The Institute at Madras is being set up with technical assistance from the West German Government. The establishment of the Kanpur institute is likely to be assisted by the U.S.A. The Indian School of Mines and Applied Geology in Dhanbad has been expanded further with additional 90 seats for mining engineering, 20 for applied geology, 20 for geophysics and 20 for petroleum technology. The Delhi Polytechnic has at present an enrolment of 1961 of whom 1442 are in the degree and diploma courses, 519 in the pre-engineering and technical higher secondary schools. Courses have also been started for part-time studies for the National Diploma in Electrical and Mechanical Engineering and Art (after Intermediate stage). A new scheme for the training of teachers in technical institutions has been taken up in the Second Plan for providing 500 senior fellowships in the scale of

Rs. 350—25—450 and 200 junior follows in the scale of Rs. 200—20—240. Under this scheme it is proposed to select brilliant young engineering graduates and diploma holders and apprentice them to senior professors in some of the selected engineering colleges. After training for three years, during which the trainees can take their Master's degree in Engineering/Technology a pool of these trainees would be formed from which the requirements of individual institutions could be met. A scheme of foreign studentships for graduates who could return to teaching after training was also initiated. The Indian Institute of Science Bangalore has been declared to be deemed equivalent to a University under the U.G.C. Act with powers to confer degrees and other academic awards etc. The Administrative Staff College started functioning at Hyderabad in 1957, where young administrators from different walks of life are provided with training facilities in the principles of organisation, administration and leadership. The Scheme "Training of Foremen and Supervisors" has been introduced in West Bengal and Madras in association with private industrial concerns for conducting Sandwich courses of the National Certificate standard in mechanical engineering. Loans to the State Governments and non-Government institutions for construction of students' hostels were provided with a view to provide ultimately accommodation to 50 per cent of the student body in technical institutions. 66 Junior Technical Schools have been planned to be set up of which about 25 are expected to be established during the Second Plan. The Central Government has also decided to meet the entire expenditure for a period of five years, for revising the salary scales of teachers in technical institutions as recommended by the AICTE. Additional facilities provided on account of Expansion programmes in terms of the Engineering Personnel Committee and the Ghosh Chandrakant Committee could be seen from the following table:—

TABLE NO. 3

Targets of expansion during the Second Plan.

	Engineering colleges		Polytechnics	
	Number	Intake capacity.	Number ^a	Intake capacity.
(i) 1955-56 Position	64	5,937	102	9,397
(ii) 1960-61—original plan (additional targets)	8	1,010	22	2,600
(iii) 1960-61 revised targets inclusive of the private effort and the recently approved Centrally sponsored programmes	33	7,560	95	16,200
(iv) Position in 1960-61 (Estimated)	97	13,497	197	25,597

56. One of the problems in the Second Plan was to cater to the requirements of industrial expansion resulting in the larger demand of personnel in mechanical, electrical communications, mining, metallurgical and chemical engineering. The following table indicates

the subject-wise distribution of intake capacity bringing out the changing emphasis from civil engineering to other branches of engineering.

TABLE No. 4
Subject wise distribution of intake capacity in 1955-56 and 1960-61.

Subjects	1955-56			
	Degree		Diploma	
	Intake	Percentage of total	Intake	Percentage of total
1	2	3	4	5
1. Civil Engg.	1911	32	3817	41
2. Mechanical Engg.	1111	19	1482	16
3. Electrical Engg.	1140	19	1460	16
4. Electrical Communication Engineering	157	3	690	7
5. Mining, Metallurgy, Chemical Engg., Textile Technology etc.	1618	27	1894	20
TOTAL	5937	100	9397	100
1960-61				
Estimated				
	Degree courses		Diploma courses	
	Intake	Percentage of total	Intake	Percentage of total
	6	7	8	9
	4049	30	10239	40
	3239	24	5887	23
	3239	24	5887	23
	540	4	256	1
	2430	18	3328	13
TOTAL	13497	100	25597	100

57. Based on certain normative studies conducted in the Technical Manpower and Perspective Planning Division of the Planning Commission, it was estimated that the requirements of Engineering Graduates and Diploma holders during the Third Five Year Plan would be about 40 to 45,000 and 70 to 90,000 respectively. As the training of an engineer took nearly five years and that of a diploma holder three years, it was felt that advanced planning had to be undertaken in respect of the creation of facilities for training these personnel. The Cabinet Committee on Manpower which considered

the report of the Ghosh-Chandrakant Committee decided that the establishment of new institutions should be re-examined in the light of the following considerations:

(a) New institutions, both for degree and diploma courses should be spread more evenly to ensure progressively equal opportunities for training all over the country, and

(b) in planning the capacity for training courses both in the existing and the new institutions, the requirements of future Five Year Plans should also be kept in view. Accordingly, the then Ministry of Education and Scientific Research prepared a scheme for the establishment of 8 new Engineering Colleges and 27 Polytechnics distributed in the different States. These proposals were considered at the 11th meeting of the All India Council for Technical Education, who approved the scheme with the modification that in view of the shortage of training facilities in the Northern Region, a new college should be set up in that region in addition to the development of the Delhi Polytechnic proposed in the scheme. The Planning Commission considered these proposals at a meeting on the 25th September, 1958 and generally approved the establishment of the engineering colleges at Durgapur (West Bengal), Jamshedpur (Bihar), Nagpur (Bombay), Bhopal (M.P.), Warangal (Andhra Pradesh), Mangalore (Mysore), Allahabad (U.P.) and Srinagar (J & K), in addition to a separate college of engineering and technology at Delhi. The location of the Polytechnics was agreed to be decided upon by the Regional Committees of the All India Council in consultation with the State Governments concerned. The following Polytechnics were proposed for the different regions:

	No. of polytechnica
1. Eastern Region	7
2. Western Region	5
3. Northern Region	8
4. Southern Region	7
TOTAL	<u>27</u>

The total cost of establishing these engineering colleges and polytechnics was estimated to be Rs. 25 crores.

II. TRAINING OF CRAFTSMEN

58. *The present position.*—The Directorate General of Resettlement and Employment under the Ministry of Labour and Employment has been running training courses through their industrial training institutes which numbered 59 in 1955-56 and which are likely to be increased to 143 by the end of the Second Five Year Plan. In the beginning of the Second Five Year Plan, the entire intake capacity under their programme was 10,500 in engineering and non-engineering trades. These centres train semi-skilled craftsmen

who will be able to obtain the required standard of skill and knowledge of the craft quickly after a short period of service in the industry. The trades in which training is imparted in the centres are as follows:

Engineering and non-engineering trades in which training is given in the D.G.R.E. Centres.

ENGINEERING TRADES

1. Blacksmith
2. Carpenter
3. Draughtsman (Civil)
4. Draughtsman (Mech.)
5. Electrician
6. Electroplater
7. Fitter
8. Grinder
9. Lineman & Wireman
10. Machinist
11. Mechanic (Dom. Refrigerator)
12. Mechanic (Instrument)
13. Mechanic (I. C. Engine)
14. Mechanic (Motor)
15. Mechanic (Radio)
16. Mechanic (Tractor)
17. Moulder
18. Painter & Decorator
19. Pattern Maker
20. Plumber
21. Sheet metal worker
22. Surveyor
23. Tool Maker
24. Turner
25. Watch & clock repairers
26. Welder (Gas & Electric)
27. Wireless Operator
28. Overseer
29. Die Fitters



NON-ENGINEERING TRADES

1. Bleaching, dyeing and printing.
2. Hand weaving of fancy and furnishing fabric with cotton, wool and silk.
3. Hand weaving of woollen fabric.
4. Weaving of Silk and Woollen fabric.
5. Knitting with hand and machines.
6. Hand weaving of newar, tape, durries and carpets.
7. Upholstery
8. Spinning (Garbo)
9. Manufacture of household utensils.

10. Manufacture of Sports goods (Miscellaneous)
11. Manufacture of Sports goods (Wood)
12. Cane, willow & bamboo works.
13. Manufacture of Footwear.
14. Manufacture of Suit cases and other leather goods.
15. Manufacture of Sports goods (leather).
16. Book Binding.
17. Hand Composition and Proof Reading.
18. Printing Machine Operation.
19. Cutting and Tailoring.
20. Embroidery and needle work.
21. Preservation of Fruits & Vegetables, including canning.
22. Stenography.

59. More trades are being added by the D.G.R.E. according to the need and training facilities. The number of seats available in these institutes at the end of First Five Year Plan and anticipated at the end of the Second Five Year Plan may be briefly summarised as follows :

TABLE NO. 5

Targets of expansion during the Second Plan—Craftsmen Training under D.G.R.E.

Sl. No.	Particulars	No. of institutes	Sanctioned seats
1.	Position in 1955-56	59	10534
2.	1960-61 original targets	63	21306
3.	1960-61 revised targets	78	24974
4.	Anticipated position 1960-61	143	38444*

The State-wise distribution of the seats is indicated in the following Table:

TABLE NO. 6

Craftsmen Training Scheme (D.G.R.E.)

Statement of Institutes and Seating Capacity

(See also list of institutions in Appendix V)

Sl. No.	Name of State	First Five Year Plan		Second Five Year Plan	
		No. of Seats.	No. of institutes	Total No. of seats	No. of institutes
		(1955-56)		(1960-61)	
1	2	3	4	5	6
1.	Andhra Pradesh	678	5	2534	9
2.	Assam	288	1	574	2
3.	Bihar	568	3	3632	15
4.	Bombay	978	6	4982	22

*This is likely to increase to 47,000

1	2	3	4	5	6
5. Jammu & Kashmir	328	2
6. Kerala	.	264	2	1848	6
7. Madhya Pradesh	.	416	1	2772	8
8. Madras	.	789	6	1980	10
9. Mysore	.	706	7	2170	9
10. Orissa	.	332	2	1116	6
11. Punjab	.	1472	7	3546	14
12. Rajasthan	.	288	2	1264	6
13. Uttar Pradesh	.	1832	8	5904	15
14. West Bengal	.	1000	6	3596	11
15. Delhi	.	784	3	1652	4
16. Himachal Pradesh	.	160	1	202	2
17. Manipur	96	1
18. Tripura	248	1
TOTAL	.	10534	59	38444	143

60. In addition to the D.G.R.E. Centres, there are a number of institutions in the country that are running training classes in subjects mentioned above. Technical training is being provided by various Central and State Government departments and agencies and in various forms, such as single trade schools, peripatetic institutions, demonstration parties, production-cum-training centres etc, and schemes are also being introduced for establishment of technical sections attached to the schools normally offering academic courses. The Advani Committee set up by the Small Scale Industries Board estimated that the total annual intake capacity for certificate courses in carpentry, wood work, building and construction, cottage crafts, engineering and technology, tanning and leather work etc. would be about 37,800 inclusive of 10,800 under the D.G.R.E. Training Centres. Further on the basis of information collected from the State Governments for the Working Group it has been found that for every 100 seats in the D.G.R.E. centres, there are about 25 seats provided in other types of institutions under the State Departments. As mentioned earlier in Chapter IV, these trade schools and production-cum-training centres under the State Directorate of Industries have been recommended to be reorganised for being affiliated to the National Council for Training in Vocational Trades.

61. The D.G.R.E. also introduced a National Apprenticeship scheme during the Second Five Year Plan, under which provision had been made for the training of 5,000 apprentices in industry. It is, however, known that the progress of the scheme has not been quite satisfactory and that the Ministry is considering introduction of legislation for compulsory apprentice training in the industries.

62. For the programme of Industrial Training Institutes and Centres of the D.G.R.E. a sum of Rs. 18.12 crores was provided during the Second Plan. It was proposed that the seating capacity of these institutes should be increased from 10,500 to 31,000 and facilities should be created for training 5,000 apprentices in the indus-

try and 3,000 industrial workers in the evening classes. For want of required cooperation and enthusiasm on the part of industry it has not been possible to admit more than 839 apprentices so far and it is hoped that this may be raised to 2,500 by the end of the Plan period, if industry could give more places for apprentice training. 739 students have been admitted in the evening classes and it is hoped that the original target of 3,000 may be achieved by the end of the plan period. On the recommendation of the Advani Committee which considered the requirements of Craftsmen in the Second Plan and arrived at a figure of 6.35 lakhs for skilled and semi-skilled persons both in engineering and non-engineering trades for industries, the implementation of further training programmes had to be considered by the D.G.R.E. As a first step they thought whether the institutional programmes of the Ministry could not be doubled. In order to do this, they decided to defer the programmes for construction of hostels and other buildings to the Third Plan and to increase the physical target from 30,000 to 47,000. Arrangement of double shifts in all institutions helped in these expansion programmes. The Training Centres under the Ministry of Rehabilitation were taken over and reorganised and brought on par with the other training centres so far as the content of training was concerned.

63. The following table brings out the position of physical targets and achievements during the Second Plan.

TABLE No. 7

Second Five Year Plan of Craftsmen Training under the D.G.R. & E.

S. No.	Name of the Scheme	No. of seats provided	No. of seats expected to be achieved	Expected Expenditure	Remarks
1.	Industrial Training Institutes and Centres	31,000	37,000*	Rs. 16.22 crores.	*Plus 10,000 in the First Plan. Total 47,000.
2.	National Apprenticeship Training Scheme	7,000	2,500		
3.	Evening Classes for Industrial Workers	3,050	3,050		
4.	Scheme of Training Instructors	N. A.	2,433	Rs. 1.90 crores.	

CHAPTER VI

ASSESSMENT OF DEMAND AND SUPPLY OF ENGINEERING PERSONNEL DURING THE THIRD AND THE FOURTH PLANS

I. SUMMARY OF OVERALL ESTIMATES OF DEMAND AND SUPPLY

64. The data collected by the Sub-Committee of the Working Group for estimating requirements of Engineering personnel and their supply has been summed up in the following table of additional personnel over a period of 15 years from 1956 to 1971.

TABLE No. 8
Demand and supply of graduates, diploma holders and craftsmen during the Second, Third and Fourth Plans

	Second Plan 1956-61		Third Plan 1961-66		Fourth Plan 1966-71	
	Demand	Supply	Demand	Supply	Demand	Supply
Graduates . . .	28,000	26,000	45,000	51,000	75,000	75,275
Diploma holders . .	54,000	32,000	80,000	76,000(a)	1,20,000	1,17,500(d)
Craftsmen . . .	6,35,000	(b)	11,00,000	(c)	(to be estimated in the Third Plan)	

(a) The shortage will be met through expansion of training facilities during the Third Plan.

(b) Institutional training would result in a figure of 40,000 to 50,000 while the rest were available through other forms of training.

(c) 3,00,000 are expected to be available through D.G.R.E. training centres and the rest are estimated to be available through other methods.

(d) Shortage will be met through expansion of facilities during the Fourth Plan.

NOTE: The particulars under 'Supply' in the Third Plan relate to the out-turn of personnel from institutions as would be functioning in 1960-61. Whereas in case of the Fourth Plan, the additional facilities which have been recommended for the Third Plan have also been taken into account.

The above table assumes as explained later that the steps taken during the third plan to expand facilities for technical education for degree and diploma courses will meet the requirements of the engineering personnel only in the Fourth Plan. In the case of craftsmen or skilled workers the facilities for institutional training are proposed to be more than doubled in the Third Plan and further estimates will have to be done in relation to the requirements of the Fourth Plan. The difficulties of assessment of supply and demand for this category have been felt, because of the different methods by which skilled workers, artisans and craftsmen are trained. A source of supply consists of persons who join as un-skilled workers or labourers and acquire skills in the course of their work. Apart from this, there are the other methods known as the traditional ones of imparting skill from father to son or brother to brother and so on

Besides, some Government Departments like Defence, Railways, Posts & Telegraphs and industries have their own methods of training this category of personnel.

2. REVIEW OF DEMAND AND SUPPLY DURING THE SECOND PLAN

65. The Engineering Personnel Committee estimated, on the basis of the approved programmes for the Second Plan, that the additional requirements of Engineering Personnel for carrying out the Second Plan programmes would be about 28,000 graduates and 54,000 diploma holders. The actual supply of graduate engineers (including A.M.I.E.'s and foreign trained personnel) during the Second Plan period may be of the order of 26,000 graduates and 32,000 diploma holders. The table below shows the requirements of graduate Engineers and diploma holders, estimated by the Engineering Personnel Committee and the estimated supply under each important category:

TABLE 9: *Estimated Requirements of Engineering Personnel and their supply during Second Plan Period—1956-61.*

Category	Demand		Supply	
	Graduates	Diploma holders	Graduates	Diploma holders
1. Civil Engg.	12445	29043	9794	16802
2. Mechanical	5300	12192	4745	4781
3. Electrical	5546	10355	4615	3626
4. Tele-Communication	1616	608	723	550
5. Mining	469	629	697	589
6. Metallurgy	693	204	475	232
7. Chemical	2256	806	1060	32
8. Technologies	Not assessed		4199	5896
TOTAL	28325	53828	26308	32508

66. The above estimates of requirements of engineering personnel worked out by the Engineering Personnel Committee related to the programmes as originally included in the Second Plan. During the course of the Plan, however, certain changes in priorities and programmes and reduction in outlay or slowing down of programmes in certain sectors influenced this estimate of demand. This would account for less shortages felt during the plan than would be apparent from the above table. Besides in order to meet the existing shortages, various methods like re-employment of retired engineers, extension of the term of employment of personnel of experience for higher jobs, relaxation of minimum qualification for certain categories of personnel in short supply etc., have been adopted. Gener-

ally speaking the shortage of overseers was reported from many parts of the country, although there were certain areas where some fresh overseers have been reported as unemployed. So far as experienced graduate engineers were concerned there were indications of marginal shortages in some parts of the country.

3. ESTIMATING REQUIREMENTS FOR THE THIRD PLAN

67. As training of engineering personnel takes between three to five years, it was felt in the middle of the second plan that if the requirements of additional personnel during the third plan had to be adequately met it may be necessary to make some forecast of the estimates early enough so that necessary training programmes could be initiated before the commencement of the third plan. The Perspective Planning Division of the Planning Commission on the basis of various assumptions as detailed in Explanatory Note I were of the view that in order to meet the additional requirements of 45,000 graduate engineers and 90,000 diploma holders during the third plan, the intake capacity in degree and diploma courses in 1960-61 should be 13,500 and 25,000 respectively as against 6,000 and 9,400 in 1955-56. In view of this urgency, steps were taken from 1958-59 onwards to expand facilities for technical education which included the establishment of 9 regional Engineering Colleges and 27 polytechnics.

68. It was considered desirable that in forecasting requirements for the third Plan, the calculations arrived at on the basis of "investment employment" ratios or "production-employment" ratios as well as ratio of employment of engineers to the total employment generated by the new economic development as revealed in the studies referred to in Explanatory Note I should be further checked up by the requirements that could be available from different sectors of industrial development like industries, power, irrigation, agriculture etc., which are the consumers of technical personnel. In order to check up these figures, a circular letter was sent to all Ministries on 17th June, 1959 (copy at Appendix VII) to get information of future levels of employment in relation to current levels on the basis of expected out-lays and targets during the Third Five Year Plan along with the norms and yardsticks applied for the calculations. Appendix VIII summarises the proposed targets of output and capacity in the Third Plan on the basis of the information received from the different Ministries and Departments. For these targets of economic development the requirements of personnel calculated will be seen summarised at Appendices IX and X for degree and diploma holders respectively. The requirements of craftsmen during the Third Plan for the same development are indicated at Appendix XI.

69. As will be observed from Appendices IX and X, estimates of requirements of engineering personnel relate to the proposed outlay of about Rs. 12,000 crores in the public sector. The tentative outlays for the third Plan now indicated for the public Sector may amount to not more than Rs. 7,000 crores. The sector-wise outlays proposed

by the Ministries and the revised outlays now indicated are given in the table below:—

TABLE 10 :—*Tentative outlays for the Third Plan.*

(Rs. in crores)

	Outlays proposed by Ministries	Revised tentative outlays
1. Agriculture and Community Development	1,621	900
2. Irrigation & Power	854	650
	1,230	900
3. Village and Small Scale Industries	330	250
4. Industry & Mining	2,068	1,300
5. Transport & Communication	3,072	1,450
6. Social Services	2,565	1,150
7. Inventories . . . . .	..	400
TOTAL	11,740	7,000

While the Ministries will be in the best position to make revised assessment of manpower requirement within the reduced outlays indicated above, some rough estimates have to be done for the purpose of provision of training facilities. The data furnished by the Ministries was checked by the information available in different Divisions of the Planning Commission. The sector-wise requirements, both for public and private sectors, as proposed by the Ministries earlier and the revised requirements in the light of the reduced outlays tentatively envisaged for the Degree and Diploma holders have been indicated in the table below:—

TABLE 11 :—*Sector-wise requirements of Engineering Personnel during Third Plan.*

	Original Estimates		Revised Estimates	
	Degree	Diploma	Degree	Diploma
1. Agriculture & Community development	2,602	4,329	1,000	2,300
2. Irrigation & Power	11,225	20,318	7,500	14,500
3. Industries & Minerals (including Small Industries)	28,286	50,955	22,300	29,700
4. Transport & Communication	8,104	18,012	4,000	8,600
5. Social Services	9,699	7,152	4,200	1,700
6. Construction programmes	6,903	34,252	4,500	21,000
7. Others	1,960	2,332	2,000	2,300
TOTAL	68,779	1,37,350	45,500	80,100

These figures are very rough and can only be provisional till the revised figures become available from the Ministries and departments concerned.

70. The category-wise requirements of the engineering personnel as estimated by the various Ministries and now assumed are indica-

ted in the table below. The basis of the detailed assumptions in regard to this may be seen in Explanatory Note II.

TABLE 12:—Category-wise requirements of Engineering Personnel during the Third Plan.

Category	Degree		Diploma	
	Original	Revised	Original	Revised
I	2	3	4	5
1. Civil Engg.	18,071	12,500	65,976	40,000
2. Mechanical Engg.	17,123	11,500	28,524	17,500
3. Electrical Engg.	16,046	11,000	23,329	14,000
4. Tele-Comm. Engg.	4,479	2,500	765	500
5. Chemical Engg.	3,621	2,300	4,067	—
6. Metallurgical Engg.	1,296	1,100	1,272	800
7. Mining Engg.	3,226	1,800	8,002	4,000
8. Others	4,817	2,840	5,415	3,300
TOTAL	68,779	45,540	1,37,350	80,100

The position regarding the demand and supply of engineering personnel during the third plan period is indicated below:

TABLE 13 :—Estimated additional requirements of Engineering Personnel of graduates and diploma holders during the Third Plan (1961—66).*

Category	Degree holders			Diploma holders		
	Demand	Supply**	Surplus(+) shortage(—)	Demand	Supply	Surplus(+) shortage(—)
I	2	3	4	5	6	7
Civil Engineering	12,500	16,700	+4,200	40,000	40,000	..
Mechanical Engg.	11,500	13,000	+1,500	17,500	16,500	—1,000
Electrical Engg.	11,000	12,700	+1,700	14,000	12,500	—1,500
Tele-comm. Engg.	2,500	2,100	—400	500	400	—100
Chemical Engg.	2,300	2,300	..	..	..	..
Metallurgical Engg.	1,100	1,000	—100	800	100	—700
Mining Engg.	1,800	1,500	—300	4,000	2,500	—1,500
Others	2,840	2,440	—400	3,300	4,000	+700
TOTAL	45,540	51,740	+6,200	80,100	76,000	—4,100

*The figures in the table have been rounded to the nearest whole number.

**Supply under Degree holders also includes about 2000 A.M.I.E.'s, and forcing trained Indian Engineers.

Requirements of post-graduates in the Third Plan

71. Requirements of post-graduates or personnel with research qualifications were not indicated by all Ministries for most of them had lumped up these requirements with those of graduates. Additional requirements, however, were indicated by some Ministries but these could be made available during the third Plan as well as the fourth Plan in fields where need is mostly felt by making necessary provision in the Institutes explained earlier in Chapter IV. Requirements are mostly felt for the purpose of building up research faculties of university Departments, Engineering colleges, Higher Institutes of technology etc. and Departments like those of Atomic Energy, Geological Survey, Communication and Civil Aviation, Public Health Engineering etc. It was also recognised that as the number of engineering institutions develop further and industrial development takes place in such a way as to require a larger number of research-minded men to accelerate the tempo of development more encouragement should be given for post-graduate and research studies. Government of India have since appointed a Special Committee to examine the question of provision of facilities for the purpose during the third and subsequent plans.

Requirements of craftsmen in the Third Plan

72. The requirements of craftsmen during the third Plan were estimated to be 15·8 lakhs of whom 10 lakhs were for the engineering trades and 5·8 lakhs were for non-engineering trades in private and public sectors. This will be evident from Appendix XI. This requirement is against an assumed outlay of over Rs. 16,000 crores both in the public & private sectors and this has now to be reduced to Rs. 10,000 crores. On a *pro rata* reduction in the total requirements has been calculated and indicated below:—

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(Figures in lakhs)

	Private Sector	Public Sector	Total
(a) Engineering trades	4·0	3·5	7·5
(b) Non-Engineering trades.	1·0	2·5	3·5
TOTAL	5·0	6·0	11·0

The assumptions made in arriving at the above estimates are indicated in Explanatory Note III.

73. The total requirements indicated above for the third Plan is of all lakhs of craftsmen and skilled workers of whom about 7·5 lakhs would be for engineering trades. Out of these about 3 lakhs are expected to be trained in the D.G.R. & E. Centres and the remaining will be trained by traditional methods or/and in accordance with the practical training programmes of various Ministries and Departments briefly described in Explanatory Note IV.

4. ESTIMATING REQUIREMENTS OF THE FOURTH PLAN AND PROVISION OF FACILITIES FOR THE PURPOSE DURING THE THIRD PLAN

74. As it was not possible for the Ministries to estimate the requirements of the Fourth Plan, because of lack of data about the nature of economic development as well as financial provision for the purpose, overall calculations had to be made for assessment of requirements on the basis of trends of development in the Second and the Third Plan. According to this approach the rough calculations are that during the Fourth Plan, the additional requirements of graduates may be between 75,000 to 80,000 and of diploma holders of the order of 1.2 lakhs. The various assumptions made in respect of these estimates are detailed in Explanatory Note. V.

75. Since it was difficult to calculate the requirements of the Fourth Plan industry-wise or sector-wise it was not possible to indicate category-wise requirements.

However, if the trends of the Third Plan were to be projected for the Fourth, the results would be as indicated in column 17 of appendix XII. The category-wise break-up of additional engineering personnel on this basis is summarised in the following Table:—

TABLE 14 :—*Estimated additional requirements of Degree and Diploma holders during the Fourth Plan.*

Categories	Degree-holders		Diploma Holders.	
	% to the total	Demand	% to the Total	Demand
I	2	3	4	5
1. Civil Engg.	25—27	18,750-20,250	48—50	57,600-60,000
2. Mechanical Engg.	27—25	20,250-18,750	22—20	26,400-24,000
3. Electrical Engg.	24—25	18,000-18,750	20—18	24,000-21,600
4. Tele. Comm. Engg.	6—5	4,500-3,750	1—2	1,200-2,400
5. Chemical Engg.	5—6	3,750-4,500	4—3	4,800-3,600
6. Metallurgical Engg.	3—4	2,250-3,000	1—2	1,200-2,400
7. Mining Engg.	4—5	3,000-3,750	2—1	2,400-1,200
8. Others	6—3	4,500-2,250	2—4	2,400-4,800.
TOTAL	100	75,000	100	1,20,000

76. The way in which these requirements could be met would be to expand the facilities of training in the existing institutions, establishment of a few new institutions and by providing part-time courses explained in the next Chapter (Chapter VII). The proposed expansion of facilities for Technical Education during the Third Plan to meet the requirements of the Fourth Plan according to the year-wise phasing have been estimated and indicated in Table 15 (Enclosed).

77. The position of demand and supply of personnel in the Fourth Plan has to be considered in the light of requirements of trained personnel in certain fields and according to the shortages that are anticipated on the basis of current intake capacity of different institutions for the types of courses that have been provided. This will mean shift of emphasis from one type of course to another and this has been brought out in the following table which indicates the surplus or shortages in different categories of personnel during the Fourth Plan on the basis of the present provision of facilities.

TABLE 15. *Estimated requirements of category-wise additional degree and diploma holders during the Fourth Plan.*

DEGREE HOLDERS

Categories	Demand	Out-turn	Surplus(+) Shortage(—)
I	2	3	4
1. Civil Engg.	18,750—20,250	18,360	(—)390—(—)1890
2. Mech. Engg.	20,250—18,750	14,345	(—)5905—(—)4405
3. Elect. Engg.	18,000—18,750	13,770	(—)4230—(—)4980
4. Tele. Comm. Engg.	4,500—3,750	2,870	(—)1630—(—)880
5. Chemical Engg.	3,750—4,500	1,150	(—)2600—(—)3350
6. Metallurgical Engg.	2,250—3,000	1,720	(—)530—(—)1280
7. Mining	3,000—3,750	2,295	(—)705—(—)1455
8. Others	4,500—2,250	2,865	(—)1635—(+)615
TOTAL	75,000	57,375	(—)17625

DIPLOMA HOLDERS

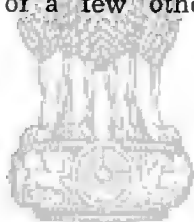
1. Civil Engg.	57600—60000	46,180	(—)11420—(—)13,820
2. Mech. Engg.	26400—24000	19,700	(—)6700—(—)4,300
3. Elec. Engg.	24000—21600	15,075	(—)8925—(—)6,525
4. Tele. Comm. Engg.	1200—2400	95	(—)1105—(—)2,305
5. Chemical Engg.	4800—3600	945	(—)3855—(—)2,655
6. Metallurgical Engg.	1200—2400	1,885	(+)685—(—)515
7. Mining	2400—1200	945	(—)1455—(—)255
8. Others	2400—4800	9,425	(+)7025—(+)4625
TOTAL	1,20,000	94,250	(—)25,750

78. What has been said about requirements of post-graduates for the Third Plan also holds good for the fourth Plan and recommendations of the Post-graduate Committee appointed by the Government of India will have to be borne in mind for the development of post-graduate courses.

79. In respect of requirements of craftsmen or skilled workers it is suggested that as the period of training is much shorter the requirements for the Fourth Plan could be estimated about the middle of

the Third Plan, when we will be in a better position to know the Development that would take place during the Third Plan on the basis of which requirements could be projected for the Fourth Plan.

80. The projections and estimations discussed in this chapter are essentially a guide to action and based on the accepted methods of forecasting requirements of engineering manpower. There may be technological changes in staffing patterns and trends of development in advanced countries indicate that needs between one industry or sector for category-wise requirements of personnel differ widely from those of another. Technical developments which might completely transform the nature of qualitative and quantitative requirements are difficult to forecast and the Working Group generally felt that the calculations should be such that the provision should be for more rather than less. This is because they felt that if practical experience of 2 or 3 years was desirable for an engineer then the availability of experienced engineers for a period of years will be slightly less than estimated. Besides, there are some gaps in information of a detailed nature and for this reason, it is recommended that there should be an organisation at the centre which will coordinate the demand and supply relationship in different sectors periodically in relation to the development for the next 15 to 20 years. This may be a Committee of representatives of Planning Commission, Directorate of Manpower in the Ministry of Home Affairs, Ministry of Scientific Research and Cultural Affairs, and of a few other Ministries utilizing the personnel.



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Table 15—Proposed expansion of facilities for Technical Education during the III Plan—1961-66 to meet requirements of the Fourth Plan

Plan	Years	D E G R E E					D I P L O M A						
		Sanctioned Intake		Outturn		Total	Sanctioned Intake		Outturn		Total		
		Full-time in colleges	Part-time and Correspondence courses etc.	From— Full-time colleges	By part-time courses		Full-time in Polytechnics	Part-time and Correspondence courses	From full time Polytechnics	By part time courses			
I	2	3	4	5	6	7	8	9	10	11	12		
II Plan	1960-61	13,500 ^a	..	..	..	..	25,000	..	..	..	..
III Plan	1961-62	14,500	375—500	8,311	..	8,311	27,000	..	12,956	..	12,956		
	1962-63	15,500	375—500	9,423	..	9,423	29,000	3000—4000	14,256	..	14,456		
	1963-64	16,500	750—1000	10,200	..	10,625	31,000	4500—6000	16,250	..	16,250		
	1964-65	17,500	1125—1500	10,625	..	10,625	33,000	7500—10000	17,550	..	17,550		
	1965-66	18,500	1500—2000	11,475	..	11,475	35,000	7500—10000	18,850	..	18,850		
III Plan	1965-66	18,500	1500—2000	11,475	..	11,475	35,000	7500—10000	18,850	..	18,850		
	1966-67	18,500	1500—2000	13,175	125	13,300	35,000	7500—10000	20,150	..	20,150		
	1967-68	..	..	14,025	250	14,275	..	..	21,450	1,000	22,450
IV Plan	1968-69	..	..	14,875	375	15,250	..	..	22,750	1,500	24,250
	1969-70	..	..	15,725	500	16,225	..	..	22,750	2,500	25,250
	1970-71	..	..	15,725	500	16,225	..	..	22,750	2,500	25,250
TOTAL	..	..	..	73,525	1,750	75,275	..	..	1,09,850	7,500	1,17,350

NOTE :— 1. Part-time course at Degree level is of a 4 years' duration with the minimum admission qualification of a Diploma in Engineering 75% wastage during training is assumed in these courses as against 15% in regular full-time courses.

2. Part-time course at diploma level is of 5 years' duration with Matriculation admission qualification. Wastage during training is assumed at 75% as against 35% for full-time courses in Polytechnics.

3. The Demand-supply position in IV Plan is as follows :

	Demand	Supply	Shortage	Surplus	Degree	Diploma
	75,000	1,20,000
	75,275	1,17,500
	(-)	2,500*
	(+)	275

*This shortage could be met by appropriate expansion of facilities during the First two years of the Fourth Plan. Further the demand for Diploma holders as indicated here may change with the changing pattern of industrial development and greater specialisation.

†The actual admission would be 1,25,000 in 1960-61.

EXPLANATORY NOTE I

(1) Assumptions involved in making the global estimates of the requirements of additional engineering personnel during the third Plan period.

(a) *Estimates on the basis of increase in national income.*

On the assumption of a 50% increase in the level of investment during the third plan period over the second period or at the rate of development implying something of the order of 5% per year increase in national income, the Perspective Planning Division of the Planning Commission in their examination of the problem arrived at certain hypothesis which might be relevant. It has been pointed out that the main targets of production envisaged by the end of the third plan includes steel 11-12 million tons, coal 110-115 million tons, electric power 11-12 million k.w., metal cutting machine tools 10000, nitrogenous fertilisers 1 million tons and so forth. On this basis the total additional requirements including replacement worked out for the third plan period were about 45,000 degree engineers and 90,000 diploma holders. The rough distribution between different types was indicated as under:

Additional Requirements of degree & diploma holders during the third plan.

	Graduates	Percentage to total	Diploma Holders	Percentage to total
1. Civil. Engg.	13500—11250	30—25	45,000	50
2. Mech. Engg.	13500—15750	30—35	27,000	30
3. Elec. Engg.	11250—13500	25—30	13500—16200	15—18
4. Others	6750—4500	15—10	4500—1800	5—2
TOTAL	45000	100	90000	100

(b) *Estimates on the basis of additional employment potential during the third Plan*

On the basis of certain norms and targets of capacity of production and outlay, the study "Outlook on Employment and Related Papers" conducted by the DGR & E and the Labour and Employment Division of the Planning Commission indicated that a net investment of Rs. 10,000 crores in the third plan would generate an additional employment for 1.01 crore persons. This happens to be further confirmed by another study done by the Perspective Planning Division who have recently estimated that for the third plan period with a net investment of Rs. 10,000 crores the projected employment opportunities would be between 93 lakhs to 107 lakhs of persons and out of this the personnel with engineering qualifications at the degree and diploma levels together may be roughly 1.10 lakhs—40,000 degree holders and 70,000 diploma holders. This, in other words, means that the requirements of additional engineering personnel would be about 1 per cent of the additional total employment to be generated during the third plan period. This proportion was also applicable to the second plan period. According to the estimates of the Engineering Personnel Committee about 81,000 engineering personnel (28,000 degree holders and 53,000 diploma holders) were estimated against the total additional employment of 80 lakhs which gives a ratio of 1:100.

EXPLANATORY NOTE II

(1) Assumptions made in estimating the requirements of additional engineering personnel during the third Plan period.

Segmental Approach.

The check list (appendix VII) issued to the Central Ministries on 17th June sought information regarding the requirements of engineering personnel on the basis of targets of production capacity and investment visualised during the third Plan period. The targets indicated by the Ministries for various sectors have been summed up in Appendix VIII. The outlays assumed and the requirements of additional degree and Diploma holders in engineering and technology calculated by the Ministries have been indicated in Appendix IX and X. It would be observed that the total outlay assumed for the third Plan is about Rs. 16,000 crores, and the estimates of degree and diploma holders, on the basis of this outlay is as under:—

Category	Degree holders	Percentage to the total	Diploma holders	Percentage to the total
I	2	3	4	
Civil Engineers	18,071	26.3	65,976	48.0
Mechanical Engineers	17,123	24.9	28,524	20.8
Electrical Engineers	16,046	23.3	23,329	17.0
Tele-Comm. Engineers	4,479	6.5	765	0.6
Chemical Engineers	3,621	5.3	4,067	3.0
Metallurgical Engineers	1,296	1.9	1,272	0.9
Mining Engineers	3,226	4.8	8,002	5.8
Others	4,817	7.0	5,415	3.9
TOTAL	68,779	100.0	1,37,350	100.0

The estimates worked out by the various Ministries were considered by different Divisions in Planning Commission and invariably it was suggested that the reduction in the requirements of engineering personnel should be proportionate to the reduction in outlays according to the tentatively approved ceilings for various sectors during the third Plan. On the basis of likely outlay of Rs. 10,000 crores during the third Plan period, the requirements of degree and diploma holders worked out would be roughly 45,000 and 80,000 respectively. It was felt that it may be very difficult to further break-up these figures into various branches of engineering but for the purpose of rough calculations, the proportions indicated by the Ministries could be adopted for the reduced requirements of personnel. In certain categories some deviations were made keeping in view the requirements of specialised categories and the commitments made in regard to the implementation of various projects and programmes. The pro-

portions of various branches assumed on this basis are indicated in the table below:—

Categories	Proportion of distribution assumed by the Ministries.	Proportions assumed by the Committee	Proportion of distribution assumed by the Ministries.	Proportions assumed by the Committee
1	2	3	4	5
Civil Engg.	26.3	27.4	48.0	50.0
Mechanical	24.9	25.3	20.8	21.8
Electrical	23.3	24.2	17.0	17.5
Tele-Comm.	6.5	5.5	0.6	0.6
Chemical	5.3	5.0	3.0	..
Metallurgical	1.9	2.4	0.9	1.0
Mining	4.8	4.0	5.8	5.0
Others	7.0	6.2	3.9	4.1
Total	100.0	100.0	100.0	100.0

2. Assumptions regarding the supply of engineering personnel during the third Plan period.

The steps taken during the Second Plan to more than double the intake capacity of engineering institutions would help the supply position in the third Plan. The year-wise intake and out-turn during the third Plan would be as under:

Supply of Engineering Personnel during the second and third Plans.

	Degree Courses		Diploma courses	
	Intake	Outturn	Intake	Outturn
	Degree course		Diploma courses	
	Intake	Outturn	Intake	Outturn
Second Plan				
1956—	6,632	4,293	10,242	4,075
1957 .	9,778	4,290	15,995	5,034
1958 .	11,086	4,665	19,932	6,345
1959 .	12,000	4,750	22,240	6,657
1960 .	12,500	5,310	25,000	10,397
TOTAL	51,996	23,308	93,409	32,508
Third Plan				
			(a)	(b)
1961 .	13,500	8,311	25,000	12,956
1962 .		9,423	25,000	14,560
1963 .		10,200	..	16,250
1964 .		10,625	..	(a) 16,250 (b) 17,550
1965 .		11,475	..	16,250 18,850
			(a)	(b)
		50,034	76,266	80,166

While working at the out-turn, it has been assumed in the case of degree courses, that it would be 85% of the intake four years earlier and in the case of diploma holders 65% of the intake three years earlier. In the case of diploma-holders the alternative figures of intake and out-turn have also been indicated. If there is no increase in the intake capacity during the third Plan period, the out-turn of diploma holders would be only about 76,000 [according to (a) above] but if the existing trend of expansion is maintained the outturn would be about 80,176 [according to (b) above] which will be sufficient to meet the demand. In the case of degree holders, in addition to the out-turn of 50,000 indicated above, we have assumed an addition of about 2,000 A.M.I.E's and foreign trained engineers. Thus the actual supply would be about 52,000 degree holders during the third Plan period. As far as the category-wise supply is concerned the expected intake capacity in 1960-61 in various branches has been assumed and on the basis of wastage which occurs in various branches, the estimates of out-turn have been calculated.

EXPLANATORY NOTE III

ASSUMPTIONS MADE IN WORKING OUT REQUIREMENTS OF CRAFTSMEN DURING THE THIRD PLAN.

Segmental Method.—The Ministry-wise and trade-wise requirements of craftsmen during the Third Plan have been indicated in Appendix XI. The sector-wise position is summed up in the table below:

Requirements of Craftsmen during third Plan.

Head	Engineering Trades	Non-engineering Trades	Total
I. Agriculture			
Community Development			
(a) Food & Agriculture	..	300	300
(b) Community Development	..	..	..
II. Irrigation & Power	73,000	..	73,000
III. Village & Small Scale Industries	11,800	2,33,000	2,44,800
IV. Industries & Mining :			
(a) Heavy Electricals, Bhopal	8,256	..	8,256
(b) Public Sector	67,900	N.A.	67,900
(c) Steel, Mines & Fuel :			
(i) Coal	23,600	..	23,600
(ii) Oils	2,919	91	3,010
(iii) Geological Survey of India	509	266	775
(iv) Iron & Steel Dept.	8,000	11,824	19,824
V. Transport & Communication (Other than Railways)	2,69,248	1,76,746	4,45,994
VI. Railways	32,900	..	32,900
VII. Social Services & Other Heads	28,461	27,997	56,458
VIII. Inventories	..	..	—
TOTAL	5,26,593	4,50,224	9,76,817
IX. Defence*	N.A.	N.A.	N.A.
X. Private Sector (Industry)	3,83,900	N.A.	3,83,900
XI. Housing (Estimated)	92,000	1,27,400	2,19,400
TOTAL	4,75,900	1,27,400	6,03,300
GRAND TOTAL	10,02,493	5,77,624	15,80,117

*The Ministry of Defence have stated that their demand is normally met by their own sources.

Public Sector.—From the above table it would be observed that the requirements of craftsmen in the Public Sector as indicated by various Ministries and estimated for various sectors, would be of the order of about 10 lakhs, during the third Plan. This, however, relates to an outlay of more than Rs. 12,000 crores against the likely outlay of about Rs. 7,000 crores in the public sector. It is not known as to how targets of the requirements of craftsmen would be affected as a result of the revised outlay but roughly, on the basis of *pro-rata* reduction, it could be assumed that the likely requirements in the public sector may not exceed 6 lakhs. Assuming the proportion between engineering and non-engineering trades, as worked out by the Ministries, the requirements of craftsmen with engineering trades would be about 3.5 lakhs and with non-engineering trades about 2.5 lakhs.

Private Sector.—As far as the requirements of the private sector are concerned, the outlay assumed is about Rs. 4000 crores against Rs. 3000 crores during the third plan and the additional requirements estimated is about 5 lakhs (4 lakhs engineering trades and 1 lakh non-engineering trades.)

Thus the total requirements of craftsmen both in the public and private sector and in engineering and non-engineering trades, during the third plan period are likely to be as under:

(Figures in ' lakhs)			
	Private Sector	Public Sector	Total
Engineering Trades	4.0	3.5	7.5
Non-Engineering Trades	1.0	2.5	3.5
TOTAL	5.0	6.0	11.0

It would thus be seen that during the third plan the rough requirements of craftsmen according to segmental approach is likely to be 11 lakhs; about 7.5 lakhs with engineering trades and the rest with non-engineering trades.

The engineer-craftsmen ratio assumed by the Ministries, according to their proposed outlays for the third plan would emerge as under:

	Requirements of additional engineers	requirements of additional craftsmen	Engineer-craftsmen ratio
Public Sector	47,000	10,00,000	1:21
Private Sector	22,000	6,00,000	1:27
TOTAL	69,000	16,00,000	1:23

The total additional requirements of engineers during the third plan, as now estimated, is likely to be 45,000 and the additional requirements of craftsmen with engineering trades would be about 7.5 lakhs (as estimated above) which gives roughly a ratio of 1:17 between graduates and craftsmen.

It would, however, be evident that the problem of assessment of demand for craftsmen is very difficult as there are no standard norms laid down regarding training or staffing. Since the data on the subject is scanty no precise and accurate estimates can be made. It would, however, be useful if some other methods are also used to calculate the requirements of craftsmen so that the results obtained are checked.

EXPLANATORY NOTE IV

PROVISION FOR IN-SERVICE AND PRACTICAL TRAINING FACILITIES

In the O.M. issued to the Ministries (Appendix VI) among other things, information was also sought regarding the action taken or proposed to be taken to train personnel through in-service and practical training. The information received is briefly indicated below:—

I. MINISTRY OF IRRIGATION & POWER.

(a) *Training of operators/mechanics for heavy earth moving equipment.*

For efficient operation and maintenance of costly earth moving machinery well trained operators and mechanics are being trained in two technical training centres which have been set up by the Central Government in collaboration with the United States Technical Co-operation Mission in India at Kotah (Rajasthan) and Nagarjunasagar. Each of these two centres have a provision for training 40 persons at each session with one year's intensive course. Recruitment is made both from open market and nominees of various projects. The minimum qualification for admission is matriculation with a licence in driving and one year's practical experience in heavy earth moving equipment. Each trainee is paid a stipend of Rs. 100 per month.

(b) *Hot line crew training programme.*

Two training centres have been established at Bangalore and Ganguwal (Punjab) to train Indian personnel for repairs, maintenance and operation of overhead power lines and equipment when they are in the energised state. The introduction of hot line techniques will effect considerably in improving the continuation of supply to power consumers. The trainees are selected among the line maintenance crews working in and sponsored by the various State Electricity authorities and major private electricity supply undertakings in the country.

(c) *Training of fresh engineering graduates.*

The intention is to give practical training to engineering graduates on irrigation and power projects.

(d) *Training serving engineers in the method of design and construction for dams and large power plants.*

The intention is to train various serving engineers of the State Governments in the methods of design and construction of dams and large power plants.

- (e) *Training reserve for the engineering offices of the Central Water and Power Commission.*

The intention is to train officers of the Central Water and Power Commission of the rank of Dy. Directors and below. The officers will be given field training in the projects.

- (f) *Practical training to be imparted during the probation to officers selected as a result of Combined Engineering Services Examinations.*

During the first six months of the probation period of two years, the officers will acquaint themselves with the problems dealt with in various Directorates of the Central Water and Power Commission and thereafter they will be sent for training on various projects for a period of 12 months. The last six months training will be in the particular Directorate to which they will ultimately be posted. On successful completion of this combined training the officers would be appointed to working posts in the Commission.

II. MINISTRY OF FOOD & AGRICULTURE.

The Ministry of Food & Agriculture have intimated the following programmes for the training of Agricultural Engineers and Sugar Technologists :—

- (a) The U.P. Government proposes to start a college of agricultural engineering and technology with an admission capacity of 75 from the year 1960 as a part of the Agricultural University proposed to be established by them at Rudarpur.
- (b) The Sugar Technologists and Pan-men are being trained by the National Sugar Institute, Kanpur which functions under the Ministry of Food & Agriculture and this institute is being developed or will suitably be developed in due course to meet the needs of the Sugar Industry in respect of Technologists. The National Sugar Institute proposes to give specialised training in sugar Engineering to such Engineering Graduates who may like to serve the Sugar Industry.

III. C.S.I.R.

- (a) National Metallurgical Laboratory, Jamshedpur proposes to train their required engineering personnel themselves.
- (b) Central Electronics Engineering Research Institute Pilani would be deputing some officers and members of the staff of the Institute to U.S.A., U.K. etc. under various foreign aid programmes. More-over the Institute would be obtaining the services of experts from foreign countries under foreign Institute in specialised fields.
- (c) National Aeronautical Laboratory, Bangalore will be organising lectures and seminars to keep the personnel advised of the latest developments in aeronautical engineering. Opportunities will also be provided for post-graduate studies either by means of external courses or internal lecture series on special subjects given by senior members of the staff.

- (d) The Central Leather Research Institute, Madras offers courses leading to M.Sc., and Ph.D., degrees and also short term refresher courses to representatives of commercial organisations, Govt. Deptts., Regional Training institutes etc. etc.

The other research laboratories and institutes have also a number of programmes where in-service and practical training is arranged.

IV. DEVELOPMENT OF ATOMIC ENERGY

- (a) The Atomic Energy Establishment, Trombay, Bombay, new recruits through in-service and practical training, are given post-graduate-training in various scientific fields including engineering to meet the special needs of the Establishment.
- (b) The Atomic Minerals Division has a system of training the new recruits through in service and practical training. A training camp is held lasting for about 6 weeks annually. The Division also proposes to organise refresher courses during the months of recess, when senior officers of the department as well as outside specialists in the field are invited to deliver lecture on their special subjects. Seminars are also held during recess, in which workers in different fields of investigation give talks on their respective fields of work.

V. MINISTRY OF HEALTH

Besides the one year course leading to a post-graduate degree in Public Health Engineering other training courses proposed are of in-service nature and of short duration of 1 to 3 months. So far as the training of personnel in Public Health Engineering is concerned it is proposed to cover a part of the staff to be employed during the Third Plan. Under the Public Health Engineering Training Programme it is proposed to arrange for the training of only 60 candidates in a year during the third Plan period. Regarding the short-term courses arrangements have been made at the Engineering Colleges at Guindy and Roorkee and at the All India Institute of Hygiene and Public Health Calcutta.

The water works operators courses are organised in major water works.

VI. HEAVY ELECTRICAL PRIVATE LTD., BHOPAL

(i) *Engineering graduates.*

50 of them are receiving training in the U.K. for the last 2½ years and about to return to India. The remaining number is under recruitment and will be sent to the U.K. and all of them are expected to be in position by 1963. Recruitment of commercial engineers is proposed to be done shortly and they are expected to be in position during the year 1960-63.

(ii) *Diploma holders.*

These are proposed to be trained in the school and some of them may also be sent to the U.K. for training.

Craftsmen

50 Draughtsmen are receiving training in the U.K. and more are being recruited for being sent for training.

Artisans will be trained in the training school at Bhopal before being sent to the factory. Training for this category of men has been envisaged under two specific schemes, viz., temporary scheme and permanent scheme. The temporary scheme to be operated for the first few years is organised to ensure an adequate supply of artisans to enable production to start by the required date and will of a shorter duration.

VII. MINISTRY OF TRANSPORT AND COMMUNICATIONS:

A. Department of Communications and Civil Aviation.

(i) *India Meteorological Department.*—A training section which is proposed to be opened at New Delhi during the third five year plan will provide theoretical and practical training to new recruits.

(ii) *Overseas communications service.*—This organisation has a scheme for a Development and Training Centre to be established at the B.W.S., Kirkee. Until this scheme is fully implemented, the training will continue to be "in-plant" at the various wireless relay stations and traffic centres of the O.C.S.

(iii) *Indian Telephone Industries.*—The Industry has its own apprentice-training scheme. There is also a technical institute attached to the Industry.

(iv) *Indian Airlines Corporation.*—Arrangements are proposed to be made by the Indian Airlines Corporation to train its personnel on the new type of aircraft to be purchased during the third five year plan.

(v) *Air India International.*—The Department has its own Engineering school which handles training requirements of the Corporation so far as A.M.Es. are concerned.

(vi) *Wireless Planning and Coordination and Monitoring organisation.*—In Monitoring organisation Job-familiarisation is necessary and for that purpose recruited personnel are initially put under training with other experienced personnel.

(vii) *Aeronautical communication service.*—Requirements of engineering personnel from outside sources are not very heavy. The Department has its own training centre and can train personnel according to the needs.

(viii) *Training and Education Organisation.*—This Department has already taken steps to train a few Glider Instructors every year at the Gliding centre, Poona. As regards Aircrafts Maintenance Engineers sufficient number of trained persons are available in the market for employment. As regards winch operators it is proposed to start a training course at the Poona Gliding Centre.

(ix) *Aeronautical Inspection organisation.*—Aircraft Examiner trainees are trained at the Civil Aviation Training Centre, Allahabad.

B. Department of Transport.

There is a national apprentice training scheme through which training is given in the Port-workshops for craftsmen like blacksmiths etc. Besides this, facilities for practical training of degree and diploma holders is also provided.

VIII. MINISTRY OF STEEL, MINES AND FUEL—*Geological Survey of India.*

- (a) With regard to the training of Geologists, the Geological Survey of India has already implemented the post-graduate university students training and staff training schemes. From 1958-59 onwards postgraduate university students are given training in field techniques while the University staff are attached to training camps organised specially for the purpose.
- (b) It is proposed to institute a scheme for giving intensive training in drilling to apprentice mechanical engineers in order to absorb them as Assistant Drilling Engineers.
- (c) It is proposed to meet the demand for Drilling Assistants (Sr. and Jr.) through the drilling camps organised by the Geological Survey of India.

Coal Industry:

(i) Four schools have been started by National Council for Development of Coal for training fitters, foremen, supervisors, Overseers, Surveyors, Shotfirers etc. Setting up of a fifth school has also been approved.

(ii) 9 institutions for conducting National Certificate course in Mining and Mine Surveying have been started in different states under a scheme approved by the Ministry of Scientific Research and Cultural Affairs.

(iii) Coal Mines regulations have been relaxed by Chief Inspector of Mines to permit graduates in Mining holding Sirdar's certificate, to act as understudy to 1st Class Managers.

(iv) Efforts are being made to secure training facilities for Indian student in U.S.A., U.K., Germany, U.S.S.R.

(v) The Railway Board are exploring the possibility of providing training facilities at Railway Workshops to technicians engaged in Coal Mines.

(vi) Special courses of 1 years' and 6 months duration in Mining and National certificate respectively are proposed to be organized in diploma institutions to train candidates already in employment in mines as Mine Surveyors and Overmen.

(vii) It is proposed to provide 1 year's practical training to degree holders in mining to enable them to sit for a second class Mine Manager's Examination and 6 months' training in Institutions during vacations and 18 months training after graduation.

(viii) A Directorate of Practical Training is proposed to be established under the Ministry of S.R. & C.A. for placement of post-graduates at collieries for their practical training.

Oil Industry:

(i) The inter-Governmental agreements entered into with the Governments of People's Republic of Rumania and USSR provides that these Governments will train Indian personnel in design, erection and operation of oil refineries in Assam and Bihar respectively. Besides the facilities available in the French Petroleum Institute Paris are also proposed to be utilised for training Chemical Engineers.

(ii) In order to train skilled workers within the country the Industry is going to have its own training centre.

(iii) Most of the Oil Companies have their own apprentice drilling/engineering pupil schemes and trade apprenticeship schemes. In addition to this, they recruit qualified engineers, who are trained by working with trained men. In general, vacancies of technical personnel are, and will be filled, by internal promotions within the Companies.

(iv) Most of the Companies have undertaken an intensive "On-the Job" training programmes for their entire work force. They plan to continue this in the third plan period.

(v) Some companies send their men for specialized training abroad with their affiliated companies. They propose to continue this practice in the future.

IX. MINISTRY OF RAILWAYS:

The Ministry of Railways have got certain training programmes which are concentrated in Central Training schools as far as possible for departments other than mechanical and electrical engineering. They also propose to set up regular schools for providing specialised training to railway employees, training in diesel and electric tractions and also propose to expand the training facilities for signal and tele-communication. The Ministry of Railways have stated that in view of the incentive schemes introduced for increased production no additional skilled manpower is likely to be required for workshops except to the extent if it is necessary to fill vacancies on account of normal wastage. The existing facilities would be adequate for training other categories of craftsmen.

X. MINISTRY OF INFORMATION AND BROADCASTING:

The All India Radio has established a staff training school for training its engineering personnel particularly the Shift Assistants who are expected to be only science graduates. This category of staff will be given intensive training to enable them to handle operational duties at the transmitter, studio and receiving centres of All India Radio. During the third plan, it is proposed to enlarge the activities of this schools.

XI. MINISTRY OF DEFENCE:

As stated earlier, the Ministry of Defence have indicated that their demand of Craftsmen is mostly met from their training institutions.

EXPLANATORY NOTE V

ASSUMPTIONS MADE IN ESTIMATING THE REQUIREMENTS OF ADDITIONAL
ENGINEERING PERSONNEL DURING THE FOURTH PLAN PERIOD.

- (i) *Estimates of engineering personnel requirements on the basis of investment during the Fourth Plan.*

It has already been observed that the Engineering Personnel Committee assessed that 81,000 engineering personnel, 28,000 degree holders and 53,000 diploma holders would be required during the second Plan period. The net investment visualised for second Plan was Rs. 6,200 crores. On the assumption that investment during the third Plan period would be of the order of Rs. 10,000 crores and the pattern of development would be roughly the same as in the second Plan it could be estimated that the total requirements of engineering personnel during the third Plan period may be of the order of 1.30 lakhs. However, on the basis of the assumption made through the segmental and global methods we have come to the conclusion that the actual requirements of engineering personnel may be 1.25 lakhs. This roughly indicates that the results obtained through the production—personnel ratio and the investment—personnel ratio is more or less the same. On this basis a ratio could be established that with an average annual net investment of Rs. 2,000 crores per year during the third Plan the annual requirements of engineering personnel would be about 24,000. The net investment during the fourth Plan period, according to the model of economic growth indicated in the second plan is likely to be of the order of Rs. 14,800 crores. According to the ratio worked out above, and assuming the pattern of development to be roughly the same as in the third Plan, the additional requirements of engineering personnel during the fourth Plan is likely to be 1.85 lakhs. The following table would sum up the position:—

Additional requirements of engineering personnel during the Third and Fourth Plan

	Position in 1960-61	Additional estimated requirements during the III Plan 1961-66	Additional requirements during fourth Plan
1	2	3	4
Graduates	57,508	45,000	67,000
Diploma holders	73,200	80,000	1,18,000
TOTAL	1,30,700	1,25,000	1,85,000

At this stage no accuracy can be claimed. There are many factors which may operate during the fourth plan period. These may relate to the change in staffing pattern and also the relationship of personnel requirements with the choice of the units. It is also likely that the priority between various sectors as laid down in the second and third Plan may be materially different than in the fourth Plan.

However, as far as the overall requirements are concerned, the figures may not be very much different. The changes may actually be in the category-wise requirements.

(ii) *Estimates on the basis of additional employment potential during the Fourth Plan period.*

The population, employment in non-agricultural sector, and engineering personnel employed in the country during the first two plans and estimated for the third plan periods are indicated below:—

*Population, employment and engineering personnel during first three plans**

(Figures in 000's)

	1950-51	1955-56	1960-61	1965-66
		I	II	III
I	2	3	4	5
1. Total population	362,000	385,000	436,000	479,000
2. Total employment in non-agricultural sector	40,000	35,500	52,000	62,000
3. (2) as percentage of (1)	11.0	11.8	12.1	12.9
4. Total engineering personnel employed	48,740	71,900	130,700	255,700
5. No. of engineering personnel per million of population	135	187	300	534
6. Engineering personnel as percentage of total employment in non-agricultural sector (4 as percentage of 2)	0.12	0.16	0.25	0.41
7. Additional employment in non-agricultural sector at the end of the plan period . . . . .	..	5,500	6,500	10,000
8. Additional engineering personnel employed (end of the Plan) . . . . .	..	23,160	58,800	125,000
9. Additional engineering personnel as percentage of additional employment in non-agricultural sector . . . . .	..	0.42	0.91	1.2

From the above table the conclusions which could be arrived at are:

- The percentage of employment in non-agricultural sector has been increasing steadily.
- The number of engineering personnel per million of population has been increasing rapidly; the percentage increase in 1965-66 over 1955-56 is 186.
- The percentage of engineering personnel to total employment in non-agricultural sector has been going up. Increase in 1965-66 over 1960-61 would be very high, and

*The estimates of total and additional employment have been obtained informally from the Labour & Employment Division of the Planning Commission.

- (d) The percentage of the requirements of additional engineering personnel to the additional employment generated in non-agricultural sector, during the first three plans has been increasing. While the percentage at the end of the second plan would be 0.91 it is likely to go up to 1.2 by the end of the third plan.

The above figures indicate the trend of development especially in regard to the increase in total employment and employment of engineering personnel.

It is expected that the total employment in non-agricultural sector by the end of the fourth Plan, due to various programmes of industrial and economic development, may be about 8.2 crores as against 6.2 by the end of the third Plan. In other words, it is being assumed that as against an additional employment of about 1 crore in non-agricultural sector during the third Plan the additional employment during the fourth Plan may be about 2 crores. If out of this additional 2 crores employment in non-agricultural sector it is assumed that one percent of it would be of engineering personnel, the additional requirements of degree and diploma holders may be about 2 lakhs. (80,000 degree holders—40% of the total additional requirements and 1.20 lakhs diploma holders—60% of the additional requirements).

The other way by which we could proceed to find out the requirements of engineering personnel would be to get roughly a ratio of the engineering personnel to the total employment in non-agricultural sector. This ratio has been rising from 0.12 in 1950-51 to 0.16 in 1955-56 to 0.24 in 1960-61 and 0.41 in 1965-66. According to the trends of development the percentage is not likely to exceed 0.55 or 0.66 in 1970-71 against 0.41 in 1965-66. In a country like the U.K. the percentage of scientists and engineers to total number employed in industries and other services besides agriculture in 1956, on an average was only 0.80*. The proportionate of qualified scientists and engineers and total number of employed staff, varied from one industry to another. It has, however, to be remembered that U.K. is a highly industrialised country and it may take us a long time to achieve the industrialisation of the order as existing in that country. The engineering personnel in 1970-71 as 0.55% of 8.2 crores of employment in non-engineering sector would be about 4.5 lakhs. Thus the total engineering personnel required during the fourth Plan would be about 2 lakhs. (4.5 lakhs in 1970-71 minus 2.5 lakhs in 1965-66). This in other words means that the average annual requirements during the fourth Plan would be about 40,000 engineering personnel.

Therefore, on the basis of these approaches it could roughly be assumed that the additional requirements of graduates would be between 75,000 to 80,000 (or 40% of 2 lakhs) and 1.2 lakh diploma holders 60% of 2 lakhs).

*Scientific and Engineering Manpower in Great Britain, Her Majesty's Stationery Office 1956 page 6.

CHAPTER VII

RECOMMENDATIONS FOR THE DEVELOPMENT OF TECHNICAL EDUCATION AND VOCATIONAL TRAINING IN THE THIRD PLAN.

81. The Working Group generally reviewed the progress of Technical education explained in Chapter V and considered how adequately the programmes for the Third Plan could be organised consistent with the large-scale development that has taken place in the Second Plan and keeping in view the new requirements created by the economic development. The assessment of demand and supply discussed in Chapter VI brings out various factors both of quantitative expansion and qualitative improvement. The latter was significant particularly in view of the difficulties that the institutions had to face in the Second Plan such as, for example, shortage of teachers and equipment, wastage and stagnation of students on account of either paucity of funds or incapacity to benefit by the courses of training, inadequate buildings and hostel accommodation, the need for staff quarters in some residential institutions and others where difficulties to recruit and retain good teachers were felt.

82. These aspects as well as those that were presented in relation to developments of similar kind in advanced countries made the Group feel that keeping in view the likely requirements of the next 15 years and the targets for provision of training facilities for the Third Five Year Plan, they had to recommend the lines along which programmes of expansion of Technical Education should be worked out by the Central Ministries and the State Governments. For this purpose certain measures were considered in respect of the nature of training as well as re-thinking about the institutional patterns; this was necessary, because the Working Group felt it incumbent on them in terms of the questions placed before them to see that measures had to be taken for the full utilisation of available technical man-power including those employed or under training abroad. They also considered the problems of higher technological education and research, staffing and administration, building and equipment, selection and placement of students. Further, the Working Group felt that as one of the best ways of preparing engineers or technicians for maintenance and construction jobs, it was desirable, as in other countries, to see that persons that are employed already had ample opportunities to further their technical knowledge and the way in which part-time courses- short-term courses and correspondence courses could be introduced on an extensive scale had to be considered for the Third and successive Plans. Engineering, as we now understand it, is of a comparatively recent origin and every engineer must undergo considerable practical training as well as receive instruction in underlying principles and the two must be intimately inter-mixed. Works training of apprentices, further practical training and training for those who are already on the job engaged the attention of the Working Group. It was felt that it was not enough to see students through inadequately staffed and ill-equipped institutions, for it was necessary to impart

to the students first rank knowledge and experience with the execution in industry and engineering designs, projects and developments; to assist the students by direct and personal experience in industry to test their aptitude for engineering course and enable engineering students to adjust themselves to engineering employments and generally prepare them for the administrative and operating functions which enter into most engineering careers.

83. The Working Group further recognised that during the Second Plan, large scale expansion had resulted in 97 colleges of engineering & technology and 197 polytechnics having an annual intake of about 13,500 students and 25,600 students respectively. It has been stated in the preceding Chapter that for the Third Plan, the intake capacity had to be increased by about 5,000 in engineering colleges and 10,000 atleast in polytechnics; about 2,000 graduates and 5,000 diploma holders being trained through other methods like the part-time courses and correspondence courses.

Further there were about 143 industrial training institutes with 33,444 seats for craftsmen training by the end of the Second Plan. The demand for craftsmen in the Third Plan has been already calculated in the earlier Chapter and the Working Group had also to consider the way in which institutional training should be imparted to those required in engineering trades on lines consistent with the development that had taken place in the Second Plan. The different recommendations on the above aspects made by the Working Group are considered in the following paragraphs.

I. OPTIMUM SIZE OF ENGINEERING COLLEGES.

84. The Working Group considered the various ideas about engineering education in advanced countries today and the training of professional engineers in the future. The education of an engineer has to be science based so that he possessed a scientific mind and was in a position to draw his conclusions on first principles rather than on the basis of hand-books or secondary data. Moreover, there could not be an engineering college in the modern sense of the term without extensive research and development work being included in the campus. Teaching of the highest type, specially in science and its application could be possible in an atmosphere of steady progress in understanding recent additions to knowledge in the subject taught. Modern Engineering research and other aspects of engineering education, i.e. instruction and training, needed a team work; for, a scientist or an engineer by himself cannot do advanced research in the highly developed technology without specialized consultations and coordinated work at different stages. The advantage of a large number of teachers in one place was that quick consultation with highly trained minds was possible for the research problems taken up in the institution. Since eminent men are few in any country, a large college could claim to have one or two of such men whose very presence should instil the atmosphere with further work and research in a team spirit. Further, a big college with a large number of teachers in each subject would result in the subject being taught at least by a few good teachers.

85. Secondly, engineering equipment becomes obsolete within 10 to 15 years and replacement in a smaller institution becomes a problem. In a larger institution, equipment is put to the full use through-

out the day and throughout the year and the cost on fully utilised equipment and its replacement is very much lower per capita. Thus, it is pointed out that the future development of engineering education in India lay in the direction of a large sized college for training professional engineers efficiently and economically. The detailed calculations in regard to pupil-teacher ratio as well as arrangement of practical and theoretical classes indicated that a sizable number would be between three to six thousands. The administrative problems of such an institution would be similar to those of a residential university, some of which will be solved by having tutors, supervisors and instructors, among whom the duties could be evenly distributed for administration supervision and instruction.

86. It is also suggested that such an institution can undertake research, development and consultation work from Government and industry, and some of the staff employed for the purpose could conveniently be utilised on part time basis for lecture and laboratory work. Some lecturers in such an institution who would be employed in Industry and Government organisations could be on part-time basis as indeed is the case in the advanced countries of USA, USSR, and UK.

87. It was pointed out that the idea of an optimum size of the college was based on the experience during the second plan of increasing the intake as recommended by the Ghosh-Chandrakant Committee. Further development on the same line could be visualised if the teacher pupil ratio recommended by the AICTE and equipment etc. are adequately provided. The Working Group recommend that in the third and successive Plans, large engineering colleges with an optimum size of 3000 to 6000 students be established in the country and a beginning be made with an intake capacity of 240, which should gradually be increased to 480 and more and the progress continuously watched. It was also considered that such institutions could be autonomous units and more departments in different subjects of engineering and technology be added to the Institutes. Some of the well established engineering colleges could be considered suitable for this development during the Third Plan.

88. What is said above about the engineering colleges was also true in a large sense about the polytechnics. In this case, however, the idea was of the functions and objectives of the polytechnics in the new social, economic and educational context and it was felt that as long as this was not clearly reviewed by the All India Council for Technical Education, the position could not be stated in a concrete form of recommendation. However, this is considered later.

II. LOCATION OF COLLEGES.

89. The Working Group recommend that the location of Engineering Colleges as well as Polytechnics should be as near industrial areas as possible. They examined various ideas in regard to the location of such institutions in the rural areas. Experience of other countries, however, indicated that the development of Polytechnics

and Engineering Colleges was so much related to urban and industrial development. The supply of engineering personnel for different sectors of development such as heavy industries, transport, power, irrigation projects, etc. was largely linked with the projects themselves. The 30 Engineering Schools in Moscow which accommodate nearly 1,50,000 students, about one-third of whom are women are an illustration to the point. The main idea is that practical training as well as training by visits to big industrial concerns would be possible within the limits of an industrialised area. Also part time teachers from industries with their practical knowledge would be helpful to the institutions only in such an area. Moreover a big Engineering College with a large organisation has to be located near a very large and highly industrialised city in order to enable the students to develop the proper mental outlook and to provide the necessary atmosphere.

III. SHIFTING EMPHASIS ON TYPES OF TRAINING.

90. An aspect of Technical Education that was considered by the Working Group was in relation to the distribution of intake in engineering institutions between different branches of study consequent to the industrialisation attempted in the second Plan and the setting up of various heavy and medium industrial projects. The field of employment potential, it was noticed, was slightly shifting from the Public Works Department for which most of the students had been trained for a century until now, towards mechanical and other branches of Engineering & Technology. Emphasis will now be more and more on Mechanical, Electrical and Chemical Engineering along with the need for training specialists in the fields of Mining, Metallurgy, Petroleum Technology etc. The Working Group recommend that a special study of the problem be undertaken to indicate the needs for different branches of Engineering & Technology, for the training facilities to be provided in the fourth and fifth Plans and a continuous assessment of manpower for the purpose on the lines commenced in the Perspective Planning Division of the Planning Commission and the Manpower Directorate of the Ministry of Home Affairs.

IV. PRACTICAL TRAINING FOR DEGREE AND DIPLOMA HOLDERS.

91. The Working Group reviewed the present position of practical training for engineering graduates and diploma holders. According to the scheme initiated on the recommendation of the Scientific Manpower Committee students passing from the institutions were assisted to equip them suitably on the practical side. Under the Practical Training Scheme Rs. 150/- per month for graduates and Rs. 100/- per month for diploma holders are awarded as stipends and the training establishments are persuaded to contribute towards the cost of stipends paid to the trainees. While some of the training establishments in the private sector share equally towards the cost, some others share the cost at a lesser percentage. Out of the establishments in the public sector, only a few contribute towards the

cost of the stipends. The following table would give an idea of the trainees from the year 1954 to 1959:

TABLE 17 : Development of Practical Training stipends scheme.

Year	No. of Senior training places for graduates.	No. of Junior training places for diploma holders	Total
1954-55	351	131	482
1955-56	645	227	872
1956-57	892	362	1254
1957-58	961	515	1476
1958-59	1133	781	1914

These places were secured in a number of industries in the private and public sectors by the Central Government. However, it was observed that training facilities secured under the practical Training Scheme in Mechanical, Metallurgical and Civil Engineering and other Technologies were not fully utilised and large number of seats remained vacant partly because of the growth of employment opportunities to engineers and technologists. Even after candidates accepted the places for training, some were absorbed in regular position in the same establishment before completion of training, thus keeping the training capacity not fully utilised. Some candidates in the course of training in the scheme were selected by various organisations like Steel Plants, Multipurpose Projects, Fertilizer Plants and other Industrial Organisations.

92. Some candidates were also selected under other schemes of training abroad such as those of the Ministry of Steel, Mines & Fuels and a few trainees were selected for teaching positions in Technical Institutions. These together constituted the bulk of vacant training places.

93. The other scheme that is current in the Second Plan is the Short-term Practical Training Scheme for about 3 or 4 months during vacations in the Institutions. Such training was, for example, provided in Railways under different trades like Foundry Shop, Forge and Smithy, Heat Treatment, Engineering Workshop, Tool Room, etc. For 1955-56: 298, 1956-57: 305, 1957-58: 354 and 1958-59: 383 candidates were provided under the scheme. There were unpaid places for trainees in the Post & Telegraph Establishment. Similar provision was made for Tele-communication Engineers for Short-term seats which averaged 50 per year during the last 4 years.

94. The Practical Training Scheme only supplements the efforts of the institutions and individual students to secure certain facilities. A large number of institutions make their own efforts and a number of Industrial organisations have their own scheme of apprenticeship training for Graduates and diploma holders. The way in which Tata Iron & Steel Company Limited, Jamshedpur, provide practical training may be cited. It is of one year's duration and every year 13 graduates are selected, 10 in Mechanical Engineering and 3 in

Metallurgy by a Sub-Committee of the representatives of the Industrial Establishments and the Regional Committee of the All India Council for Technical Education and the Ministry of Scientific Research & Cultural Affairs. During the first 6 months general training is given after which a Department is given for the trainees for specialisation depending upon their purpose.

95. In the U.K. and other countries apprenticeship training is generally imparted in larger engineering firms for about two years enabling them to secure knowledge of processes and skills employed in industry. In the U.S.A. the Engineering Graduates are recruited very often in industrial concerns directly from colleges and Universities for initiation in training in industry for jobs to which they would be assigned later. Formalised training schemes for the purpose vary widely in character and detail according to the nature of industry. But normally, the trainee is sent to various departments after a few weeks of class room work conducted by experienced members of the firm and later he is sent to the various departments within the field in which he is expected to settle down. In the U.S.S.R. practical training is arranged as a rule of for the senior students as a component part of the educational process. During their studies they are required to undergo practical training in 3 terms ranging from 6 to 12 weeks each. Very often students undergo their pre-graduate practice at the factories where they would subsequently receive permanent positions.

96. The Working Group recommend that Practical Training facilities need to be further developed for the increasing number of engineering graduates & diploma holders that would be turned out and suitable provision of necessary places with adequate finances be considered in the Third Plan.

V. SCHOLARSHIPS AND LOANS.

97. The Working Group realised that on the basis of the evidence placed before them in regard to wastage in engineering colleges and polytechnics—a subject discussed later—the training capacity of the institutions was not being fully utilised and it was necessary to consider the steps by which these defects could be overcome. While it was realised that stagnation on account of failures in examination was part of the wastage and the remedy for this was to improve the institutions both from the point of view of laboratory equipment, teaching methods and employment of adequate staff, there were other reasons for wastage as well, which include the number of students who left the institutions for various reasons, such as, financial difficulties, delay in awarding scholarships, and difficulties in following the courses of instruction on account of lack of aptitude. Members of the Working Group were unanimous in their view that financial difficulties were being faced by a large number of students and these were likely to increase with the larger intake of students in the institutions. Moreover, the best students who would have liked to be admitted to these institutions could not very often take up the courses for want of financial resources. In a survey conducted in one of the colleges, it was pointed out that 50% of the students came from the income-group having a monthly family income of Rs. 100 to Rs. 200/- and the expenditure per student was in the range of Rs. 130 to Rs. 160 per month. Some of

the indigent students were assisted by contributions or loans advanced by institutions and in some institutions a loan fund was established though contributions from various sources and utilised for this purpose, but hardly 10 to 16% of the students could be assisted in this way out of about 50% students who need assistance. It was felt that a loan fund for boys could be created by the Government of India and the State Governments. It was also pointed out that it was not difficult for boys to return the loans in regular instalments after they had started earning. An amount for this purpose should be placed at the disposal of the institutions who could be made responsible for the recovery of the repayable loans. A view was expressed that a large number of scholarships would be more desirable as realisation of loans often create hardships for some youth earning engineers. However, the experience was that such cases were very few and though such scheme would involve administrative difficulties it was recommended that full or partial scholarships to a few students on merit and loans on more liberal scale should be provided to majority of students in the institutions.

98. The Committee on Degree & Diploma courses examined this question in details and recommended that it would be desirable to assure merit scholarships of about Rs. 50/- p.m. each to about 10% of the student population. The rest of the students who may need financial assistance should be given interest free loan scholarships. Loan Scholarships may also be made available to merit scholarships holders in addition to the amount of their merit scholarships. The advantages of an insurance scheme covering the loan amount should also be examined and considered. A loan scheme started in this way should create in a few years a self-generating fund for each institution which it could use with advantage. The experience of Orissa Government, which had such a scheme working for more than a decade was an illustration of administrative success. It was further recommended that details of such a scheme should be worked out by the Ministry of SR & CA and for the purpose of calculating the total amount of loans and scholarships fund, 33% of the student population may be taken as a basic number and the amount required per annum per student could be estimated on the basis of Rs. 1200/- per annum per student for degree courses and Rs. 900/- per annum per student for diploma courses. The total amount thus arrived at should be distributed among 10% of students for merit scholarships of amounts varying from Rs. 25 to Rs. 50 per month and the balance of the amount should be distributed as interest free loan to the largest number of needy students that could be accommodated within the ceiling. Such a scheme should be introduced over and above the existing schemes of scholarships in Government and private institutions which would in the long run get rationalized into the scheme in each institution. Another recommendation of the Committee was in regard to harnessing community effort to finance scholarships and loan fund scheme, for which Government should provide a matching amount of Rs. 1 crore and this should be made available to the institution on a matching basis, wherever an institution had been able to secure funds from Trusts or Community for the purpose. It was also recommended that part-time employment for some of the needy students in industries and trades might be helpful and the way in which steps in this regard could be taken should be considered by the Ministry of SR & CA.

VI. EQUIPMENT.

99. A study* undertaken in the Education Division, Planning Commission, on the basis of a questionnaire to technical institutions revealed difficulties in securing the equipment. The Working Group commended the Government effort to encourage manufacture of scientific instruments etc., through a machinery suitable for the purpose and also realised that some equipment required for the institutions was to a certain extent available from manufacturing concerns in India, recognising also that some equipment should be fabricated in the workshops themselves. The Working Group recommended that suitable steps should be taken to see that institutions are properly equipped and the obsolete equipment is replaced in engineering colleges and polytechnics. It was also noted that the equipment list which was prepared some years ago mentioned prices for equipment which no longer are current in the market, as in some cases they have gone up by nearly 50% and a special committee appointed by All India Council for Technical Education has been examining this question. In the light of the recommendations of this Committee, institutions will have to be assisted financially to procure equipment at a higher cost if necessary for this important item of qualitative improvement. It is also recommended that the suggestions of this special committee in respect of the indigenous production of equipments and a centralised organisation for procurement of equipment produced both inside and outside the country need to be considered.

VII. TECHING PERSONNEL.

100. The Working Group recommend that the suggestions made in respect of recruitment policies by the Engineering Personnel Committee, 1956, needed implementation; because complaints even now persisted particularly in Government departments and Government colleges about delay in recruitment in spite of the fact that Engineering Personnel Committee's recommendation for one or two bulk selections was being implemented. They also recommended proper utilisation of the Indian nationals securing technical education abroad, though they recognise that some steps have been taken by the Government of India in this direction. The Working Group also reiterate what the Engineering Personnel Committee have said about conditions of service for teaching staff in engineering institutions and suggest that while steps taken in connection with raising of salary scales of teachers during the second Plan have had immediate effect on improving the staffing position of the institutions where higher scales have been introduced, the other suggestions made by the Engineering personnel Committee in regard to allowing serving engineers who display a special aptitude and potentiality for research to enter such work on adequate remuneration and encouraging consultation work by the teaching staff as well as acquiring field experience in industrial enterprises and engineering projects for teachers to help them keep in touch with the progress taking place in current engineering practices should be implemented. The Working Group also recommended that in view of the fact that certain engineering colleges in some States have expressed difficulties in securing adequate staff for their institutions on salaries which have not been revised such States may be advised to take immediate steps

in implementing the salary scales recommended by the All India Council for Technical Education. The teacher training scheme introduced by the Ministry of S.R. & C.A. will have also some effect on easing the position of shortages of teachers but teaching personnel that could be available as a consequence of introduction of the fellowship scheme could be employed only in institutions where revised salaries have been made applicable.

VIII. PART-TIME, SHORT-TERM AND CORRESPONDENCE COURSES.

101. The Working Group considered the various methods of extending facilities for Technical and Technological training based on the war-time experience and the methods followed for such schemes by the Ministry of Defence as well as the various ways in which these facilities are provided in the foreign countries. Apprenticeship training, sandwich courses, part-time and short-term courses, day-release schemes and correspondence courses were suggested. The following figures give an idea of the number of students for further education in grant-in-aid establishments in England & Wales in 1954-55:

Full time	64,000
Part time	402,000
Evening only	1575,000
TOTAL	2041,000

It will be seen from the above that the part-time day students and evening students are more than 90% of the total number of students for further education of which of course, courses for Technical Education and commercial training form a major part. (White Paper on Technical Education 1956, pages 8-9). The part-time route is a recognised way of training students and in recent years short post-graduate courses have been provided in the U.K. for the benefit of scientists and technologists employed in industry, who wish to bring themselves up-to-date with the latest developments. In 1954, some 900 courses of this type were organised. In Scotland, for example the Central Institutions like the Royal Technical College, Glasgow themselves provide a wide range of part-time courses. At first, these were held in the evening. But later, part-time day classes were added. These courses ranged from those at higher national certificate level to pre-national certificate courses for boys, who have just left school, courses for City and Guilds Institute Examinations or courses of a purely practical nature for young apprentices. Some of these courses in recent times are being gradually transferred to local centres run by education authorities. The following figures indicate the number of part-time students attending the 7 Central Institutions in Scotland:

Year	Day	Evening	Total
1946	1238	5844	7082
1954	4422	10349	14771

(White Paper on Technical Education 1956, p. 27) It will be seen that the evening students are more than double the number of day students in 1954.

102. In the U.S.S.R., acquiring specialised secondary or higher education after working hours has been widely developed in recent years. The number of higher institutions having correspondence departments, special correspondence institutes and technical schools has been growing every year. In 1955-56, there were 22 higher correspondence schools exclusive of correspondence faculties and sections at regular schools and 41 specialised secondary correspondence schools. Students at specialised secondary correspondence schools and sections numbered 288,500, and at higher correspondence schools 639,100. In 1956, there were 14100 post-graduate students trained in the same way. (USSR reference book 1957, page 191). The following table states the position for the year 1955 regarding enrolment of students by various types of instruction:

Type of instruction	Enrolment 1955
Resident, Full-time	450,000
Resident, evening	100,000
Correspondence	100,000
TOTAL ENROLMENT	650,000

(Alexander Korol, Soviet Education for Science and Technology, p. 142).

103. The Extension Correspondence Training in the USSR is conducted as follows: The rules of admission to correspondence institutions and departments are similar to those for ordinary higher educational institutions except that there is no age limit. Those admitted must have completed a 10-year secondary education or its equivalent and have passed the competition entrance examination for their major field. In addition to the standard application required by Soviet Universities and Institutes, a part-time student must submit information from his place of employment on the type of position he holds and on his speciality. Correspondence students cover the same curriculum as that approved for regular students. A correspondence student enrolled in any institute spends 30 days in summer and 10 in winter at the Institution itself. In certain programmes a student spends some days in a year at the Centre either in summer or winter depending on his work. During this time, a student does the laboratory work, takes examinations, attends review lectures, attends introductory lectures on the subjects he will study in subsequent term and, take part in seminars. He has an opportunity to consult his Professors and must pass the required tests and examinations. Through this period he is given leave with pay. (Education in the USSR 1957, U.S. Office of Education, Bulletin No. 14, page 198).

104. In the U.S.A. since the war, the correspondence courses have become popular and they are conducted by the Colleges and Universities especially the State Universities for High School and College students as part of the programme of the University Extension. In the year 1957, there were 38635 part-time and evening undergraduates in Engineering Institutions which was 14.4% of the total Engineering enrolment in the country. (Engineering Enrolments and Degrees 1957, US Office of Education Circular No. 516).

105. The Working Group on Technical Education appreciated that a useful avenue of increasing the output of engineers suitable for normal maintenance and even construction jobs could be envisaged by the introduction of part-time courses in the existing polytechnics and other institutions providing facilities for the purpose for persons possessing necessary basic educational qualifications and engaged in engineering occupations. The need for this was greater as more industries developed and the kinds of occupations and specialised jobs increased. Such courses would prepare candidates for the examinations of professional institutions, for example, Institution of Engineers (India). The way in which part-time courses, short-term courses, correspondence courses and sandwich courses should be planned need to be examined further. On the basis of data placed before the Working Group, it was felt that Correspondence Courses should be of special value in imparting instruction to persons already in employment, mostly with a view to improving the knowledge and skill in their present employment. But such courses imply a fairly high standard of minimum general education as illustrated particularly by the highly developed courses in the USSR. For the benefit of workers with necessary education and technical background, courses for national certificate as well as for advanced training could be organised in this way in technical institutions selected in each region. The Working Group recommended that the Chairman might consider this question in a small Committee and secure further data in regard to the organisation of such courses in countries like the USSR, the US and the U.K. by visits, if necessary, and the Committee should be in a position to prepare a workable scheme for implementation in the Third Plan.

IX. SCIENTIFIC GUIDANCE IN SELECTION TO DIPLOMA AND DEGREE COURSES.

106. One of the points considered by the Working Group was that some students did not have the aptitude for the courses they undertook and they left their studies after some time contributing to the total wastage and it was thought that applicability of psychological tests to students before admission to technical institutions might be considered as one of the measures to deal with the question. On the other hand, some members of the Working Group felt that the examination results, particularly at the degree level justified to a great extent the present system of selection and admission *viz.*, written examinations, medical boards and interview boards. The experience of some of the technical institutions, where examination results were correlated with the results of psychological tests did not fully justify a separate psychological test. Further, there were practical difficulties in applying the aptitude tests particularly when large numbers were involved in the selection before admissions with wide variations in the educational background of the students from region to region. However, in view of the fact that the Defence Services had employed

these tests successfully in reducing the wastage in technical manpower and also in view of the fact that many students admitted in the first year of the technical courses needed proper guidance in their choice of branch of engineering for specialised study, it was recommended that aptitude tests should be tried by institutions as an experimental measure and the results carefully watched. At the same time, certain guidance to students admitted has to be provided by the institutions themselves.

107. Because of the difficulties of students rushing in for admission without being properly informed of the availability of various courses in different institutions and the nature of work that they would be required to take up on joining the institutions, it was necessary to have guidance literature available to them. The Working Group recommend that in order to provide adequate information about the type and nature of courses offered by different institutions, the Ministry of Scientific Research and Cultural Affairs might revise their publication giving information about courses offered in the various engineering institutions in the country.

X. RECOMMENDATIONS—DEGREE COURSES.

108. The Working Group further make the following recommendations in respect of degree courses in engineering:

(i) Admission to engineering colleges should be on the basis of merit so that only those who would benefit by the higher education/training are admitted to the course, taking into consideration also the special requirements of backward classes and communities in accordance with the rules made in this behalf by the Government.

(ii) The minimum qualifications for admission should be a pass in the higher secondary examination for a five-year integrated degree course and during the transitional period before the higher secondary course is introduced in different States, the recommendations of the AICTE may be followed.

(iii) Relaxation of one year out of a four-year course may be offered to B.Sc.s. who qualify at an admission test of B.Sc. standard open to B.Sc.s. only. It is further suggested that B.Sc.s. who are allowed such relaxation should be required to put in additional two or three months preferably before the commencement of the session to get a block course in engineering subjects which have been taught in the year prior to such admission i.e. in the first year of the four year course or the first two years of the five year integrated course. For the remaining three years, the B.Sc. students could attend the same courses along with other students.

(iv) Special relaxation may be offered for B.Sc. students in Mathematics, Physics and Chemistry selected on approved basis to enable them to take technological courses for a period of two years qualifying them to a degree of M.Sc. (Tech). Similarly, the post-graduate courses for graduates in Engineering could be designed in certain subjects of pure science with a view to developing engineer-scientists for designing, creative thinking and research.

(v) In respect of the out-turn of engineers, the Working Group recommend that provision of additional facilities for training them should be made in the third plan on the side of surplus as that would leave reasonable margin for selection for ensuring quality in addition to ensuring adequate supply of engineers for any emergency, such as,

sudden expansion required in a particular sphere of industry, new schemes where initial estimate of personnel has been exceeded by later developments and certain unforeseen new developments in the existing industrial and other projects.

(vi) The Working Group noted with satisfaction that during the second plan expansion has taken place on the basis of the recommendations of the Ghosh-Chandrakant Committee. The problem during the third plan specially would be the consolidation of the expansion programme and implementation of further programmes of improvement undertaken in the second plan on the basis of the experience gained. It is recommended that expansion of existing institutions into bigger units of optimum size, where possible, would invariably be preferable to starting new institutions. It is further recommended that this improvement should generally mean strengthening of staff, training of teachers, improvement of research departments, suitable building programmes for inadequately housed institutions; provision of hostel facilities to an average of 50% of the student population of degree colleges and the polytechnics, provision of teachers' quarters, replacement of obsolete and addition of new equipment and various other forms of qualitative improvement.

(vii) The Working Group considered the question of mining and metallurgy courses in technical institutions. It was felt that the mode and content of apprenticeship training and practical training given to the candidates for diploma and degree courses in mining and metallurgy needed very careful examination and consideration and that Government and industry should be requested to provide in-service practical training to all new entrants. It was noted that a Joint Committee of the All India Council for Technical Education and the Steering Committee of the Coal Council was examining the problem.

(viii) The Working Group also recommend that the question of expansion of additional facilities for *Agricultural Engineering Courses* should be considered in the light of development of soil conservation work and other related problems. The AICTE have already considered the recommendation of the Agricultural Personnel Committee in 1959 and have expressed their view that the question of providing additional training facilities be deferred pending proper utilization of personnel turned out by institutes like the I.I.T., Kharagpur.

XI. RECOMMENDATIONS—DIPLOMA COURSES.

109. The Working Group make the following recommendations in respect of diploma courses:—

(i) The Working Group felt that it was time for some new thinking in regard to the objectives and functions of a polytechnic and considered that the institutions should be organised particularly in big cities on a bigger scale and they should in addition to the present regular training at the post-Matriculation level both on full-time and part-time basis, for Diploma Courses in Electrical, Mechanical and Civil Engineering, arrange Short-term courses in a variety of subjects. The number of such Courses to be introduced in the various Polytechnics would depend upon the requirements of the local community and the demand in numbers. Such courses should be for adults above 18, the technical training requirements for the age groups 11 to 17 or 14 to 17 being met by appropriate institutions at the secondary stage of education.

110. The Working Group also noted that in the consolidation and expansion of technological training the polytechnic would play a significant part if it was developed on lines in which institutions of a similar kind worked in the U.K. In the light of the functions and objectives it ought to perform the Group recognised that it may be difficult at the present moment to develop these institutions in the same way as, for instance, the Regent Street Polytechnic*, which attracted a large proportion of working men, particularly artisans. This institute, it was noted had 1722 full-time senior students, 494 part-time Day Release Students, 10,376 evening students, 601 other part-time day students, 188 students for post-advanced and graduate courses, with a total of 18,440 students in the year 1955. The teaching staff consisted of 155 full-time, 72 part-time day and 486 evening teachers. The departments included architecture, surveying and building, commerce, art, chemistry and biology, mathematics and physics, languages, domestic science, management studies, photography, physical education for men and women and the standard of courses ranged from those for the external London University Degrees to professional examinations in Accountancy, Town Planning, Engineering, Management Studies etc. It is an institute, in other words, for "Further Education" in making provision for students both men and women. Similarly, the Northampton Polytechnic@, London, has a total population of more than 5000 students of whom more than 3000 are evening students. The question for consideration is whether the polytechnics we have established are likely to move in the direction of institutions for further education in different respects and different subjects for an all-round activity for people in employment and others both for cultural and recreational and professional purposes. The Working Group recommend that a further study of the problem be undertaken with a view to seeing that the polytechnic is established in appropriate relation to our social, educational and economic requirements.

(ii) It was noted that the AICTE had laid down that the basic qualification for admission should generally be a pass in the Higher Secondary class or Pre-University class and the course should be of a three years duration.

They had also recommended that the students from the technical streams in a higher secondary School should be admitted to the second year of the course under certain conditions. In view of the fact that the conversion of high schools into higher secondary schools is likely to be spread over a period of time, a problem could arise when both high and higher secondary students would have to be admitted in the first year of the three year diploma course. The Working Group recommend that appropriate bodies like the AICTE should consider the anomaly likely to arise in such a situation and suggest suitable measures to remedy the same.

(iii) It was noticed that at present in the states coming under the purview of the Eastern Regional Committee of the AICTE the intake capacity is 180 per polytechnic, while in other regions it is 120. It is recommended that the All India Council for Technical

*Venables—Technical Education P. 63.

@Ibid P. 64.

Education may consider whether the intake capacity should not be uniformly 180 in all the regions.

XII. TRAINING COLLEGES FOR TECHNICAL TEACHERS IN POLYTECHNICS ETC.

111. The Working Group considered it desirable to organise special training courses for teachers in technical subjects required for polytechnics and secondary schools, and recommended that the question of setting up training colleges for technical teachers should be considered on an all-India basis and some centres established for the purpose.

XIII. TEXT BOOKS

112. It was noted that the Ministry of Scientific Research and Cultural Affairs were already considering the question of augmenting the supply of technical books and literature at more reasonable cost for the increasing number of students undergoing training in engineering institutions.

XIV. INDIAN SOCIETY FOR ENGINEERING EDUCATION

113. It was desirable in the opinion of the Working Group to bring into existence an organisation of all teachers of engineering to be known as Indian Society for Engineering Education. It was recommended that the Government should consider assisting the organisation when it was brought into existence. This was intended to serve as a forum for teachers and others interested in problems of technical education to meet and discuss problems of teaching and other related matters, on the pattern of a similar association in the U.S.A. The Working Group thought ultimately the future development of technical education in the country should be guided and planned by a well organised teachers' association and professional interests.

114. The following recommendations were made in respect of craftsmen courses:—

XV. IMPORTANCE OF THE PROBLEMS AND METHODS OF ESTIMATE:

115. The Working Group noted that the Engineering Personnel Committee (1956) had expressed fears about difficulties of assessing the demand and supply of personnel in the category of craftsmen because the different types of craftsmen in the engineering and non-engineering trades were so many and requirements of different undertakings so varied that reliable data was difficult to obtain. Besides, it was pointed out that employing authorities do not very often indicate the main categories of their demand exhaustively; nor do they assess adequately the numbers required even under the category chosen.

The methods by which craftsmen are trained are also of varied kinds. The institutional training meets the demand of skilled workers to a small percentage and the other source of supply consists of persons who joined as unskilled workers and acquired skills in the course of their work. There is also the other group of craftsmen who learn their skills imparted in the family from "father to son", from "brother to brother", etc. and apprenticeship in industries.

117. The Technical Training Committee of the Small Scale Industries Board, Ministry of Commerce and Industry, known as the Advani Committee (1957-58) assessed the demand of skilled workers and supervisors for small scale and other industries based on normal wastage and expansion of industrial development during the second plan period and suggested the types and numbers of special institutions to be extended or newly established. They suggested that arrangements should be made during the second plan for training 6.35 lakhs of persons for skilled and semi-skilled groups to meet the total expansion and replacement demands of the large, medium and small scale industries after allowing for wastage during the training.

118. By employing the "global method" of projecting the requirements on the basis of ratios, such as the ratio between skilled workers and engineers, certain estimates were possible and these have to be checked up with the other method based on actual requirements in individual industries and trades, but the latter field was difficult estimate because of lack of full data. Another method is that of calculating the skilled workers as a percentage of total employment in an industry or trade. This is the normal method employed in the U.S.A. According to this method, we would arrive at a total requirement of about nine lakh of persons in the engineering trades of whom nearly about three lakhs could be provided by institutional training under the DGRE during the third plan and the remaining through the other methods mentioned below. A tentative exercise of the estimates based on investment pattern in the third plan compared with that in the second plan indicates that the total requirement of skilled and semi-skilled workers in both engineering and non-engineering trades would be of the order of 13 lakhs. Such global estimates require a proper check up and an analysis of how and where the skilled manpower could be trained and where employed.

XVI. TRAINING

119. Craftsmen are at present trained in different ways in various institutions. The following forms of training were noted for the purpose:—

(a) Government Departments having their own training facilities like Defence, Railways, Posts and Telegraphs, and major heavy industries in the private and public sectors—apprenticeship.

(b) Facilities organised in the industrial training institutes and centres (I.T.Is and I.T.Cs) under the scheme of the Ministry of Labour and Employment (D.G.R. & E.) The National Council for Training in Vocational Trades is generally in charge of the programmes of training in these institutes.

(c) Facilities organised by the Ministry of Commerce and Industry for small-scale industries which are being integrated with (b) above.

(d) Proposals for facilities for rural artisan training of the Ministry of Community Development and Cooperation.

(e) Unrecognised organisations for training craftsmen in the country.

(f) Traditional methods of training craftsmen like "father to son" etc.

120. The Working Group made the following recommendations in this regard:—

(a) So far as facilities provided by the D.G.R. & E. on the advice of the National Council for Training in Vocational Trades are concerned, it was estimated that by the end of the Second Plan, provision would be available to turn out about 47,000 craftsmen out of 143 existing institutions under the D.G.R. & E. These may be further expanded and new ones established so that in the Third Plan, a total number of about 2 lakhs of craftsmen would be trained by these institutes.

(b) It was noted that the Deputy Chairman, Planning Commission in his inaugural speech at the first meeting of the Working Group on 13th and 14th March, 1959, referred to the different kinds of technical institutions for giving technical and vocational training courses initiated by different Ministries and stated that it would be very useful to review the working of the different kinds of institutions and to see whether some kind of coordination could not take place. He added "that it was perhaps, time to consider how a coordinated structure of vocational education throughout the country could be brought about". The Working Group considered this aspect of the problem. One of the functions of the National Council for training in Vocational Trades is, it was noted, to coordinate all the training facilities in the country so as to ensure there was no duplication of efforts and wastage of resources. Though the Council had a number of sub-committees for craftsmen training—apprenticeship training etc., there was no sub-committee for co-ordination and the Working Group recommended that a Sub-Committee for Co-ordination may be formed under the National Council with representatives of the concerned Ministries like Railways, Defence, Commerce and Industry, Steel, Mines and Fuels, Scientific Research and Cultural Affairs, Education, Labour & Employment, Transport & Communications, Manpower Directorate of the Ministry of Home Affairs and the Planning Commission. In view of the fact that one of the objects of this sub-committee would be to examine training programmes of the various Ministries, it was thought desirable to locate the Secretariat for this Committee in a coordinating agency like the Planning Commission.

XVII. APPRENTICESHIP TRAINING

121. The development of training programme for craftsmen during the third plan and subsequent plans will depend very much on the proposed legislation for compulsory apprenticeship in factories under consideration of the Ministry of Labour and Employment. The Working Group considered the suggestion of the Apprenticeship Training Committee appointed by the Small Scale Industries Board that in order to enable factories to accept apprentices above 5% of the labour force or 10% of the strength of their additional unskilled employees, separate sections for training should be set up with additional equipment and suitable qualified staff. In the case of factories, it was suggested, employing 500 workers and above, the cost of establishing these training schools should be wholly paid by the factories themselves; the Government might however grant a loan to meet the cost of land, building and equipment. For apprentices in the other factories, separate training sections might have to be set

up by joint effort for the cooperative use of a number of factories and the Government should bear the entire cost of land and equipment and also share with industry the recurring expenditure on 50:50 basis. The Working Group recommended that the proposed legislation be expedited to ensure an early implementation of the programmes of apprentice training.

XVIII. JUNIOR TECHNICAL SCHOOLS AND TECHNICAL STREAM IN MULTI-PURPOSE SCHOOLS.

122. The Working Group considered the training schemes of junior technical schools of the Ministry of S.R. & C.A. and technical stream of the multipurpose schools as recommended by the Ministry of Education. The Working Group noted the recommendations of the special committee appointed by the Planning Commission under the chairmanship of the Cabinet Secretary, to consider the problem on 2nd July 1959, and generally endorsed their conclusions which are as follows:—

(i) There was need for training of a much larger number of craftsmen for the third, fourth and subsequent plans consistent with programmes of economic and industrial development.

(ii) The existing training facilities, particularly those provided in the D.G.E and T. Centres will have to be considerably expanded for this purpose and other experiments to train technicians in an organised way would have to be encouraged and evaluated.

(iii) It was agreed that in order to utilise fully the capacity of polytechnics which might number about 200 by the end of the second plan, it would be useful to locate the proposed junior technical schools in the polytechnics by making necessary arrangements and adjustments in instructional programmes.

(vi) For the time being the number of junior technical schools may be limited to about 60 which were proposed to be established during the second plan period and in case the experiment was found to be a success further schools of the same type may be established in the polytechnics whose number is likely to be 200. This will bring down the cost of junior technical schools considerably, by the use of the buildings and equipment of the polytechnics.

XIX. RURAL ARTISAN TRAINING CENTRES.

123. With the industrial development proposed during the third plan for rural areas particularly for industrial co-operatives it is felt that need for training artisans in rural areas has to be recognised. The scheme proposed for the purpose has been examined by the Working Group's Committee on Craftsmen Courses who appointed a Sub-Committee to examine the scheme in relation to certain administrative difficulties like dearth of qualified instructors and feasibility of it as a separate programme. The Working Group, however, recommend that this form of training artisans should also be brought within the purview of the National Council for Training in Vocational Trades of the Ministry of Labour and Employment and provision be made in the Third Plan for training taking into consideration the actual requirements and the extent to which the training programmes of the all-India Boards, Khadi and Village Industries Commission etc. would benefit the rural artisans.

XX. TRAINING OF INSTRUCTORS

124. The programmes of craftsmen training envisaged for the third plan would need a large number of teachers for the industrial trades taught in the Industrial Training Institutes. In the light of the proposals of the D.G.E and T for expansion of training facilities during the Third Five Year Plan, it was estimated that the requirements of instructors for the Industrial Training Institutes would be nearly 11,000 in addition to which the demand by the other Ministries and private establishments will also need to be met. It was noted that on the recommendation of the National Council for Training in Vocational Trades, the D.G.E. and T have proposed to establish 4 more Central Training Institutes in the country in addition to the ones existing at Koni-Bilaspur and Aundh, Poona, which are shortly being shifted to Calcutta and Bombay respectively. In view of the fact that the large programme of expansion envisaged in the first year of the Third Five Year Plan would need a good number of instructors, the Working Group recommended that the D.G.E & T. may be requested to make a beginning in respect of the establishment of the four additional Crafts Training Institutes during the last year of the current Plan with adequate provision for the spill-over expenditure into the Third Five Year Plan.

125. There is an acute dearth of technical men with necessary skill and experience as they find better prospects in industry owing to the rapid industrialisation that is taking place. Further personnel with the required industrial experience and also knowledge of teaching training techniques are not available in the country. It was, therefore, considered an urgent need to secure foreign assistance for the Central Training Institutes in the form of machine tools and experts as trainers to start with. It was noted that the Special Project Fund of the U.N. have agreed to make available \$ 860,000 for the institute being set up at Calcutta. A project of assistance from the T.C.M. has also been prepared for the C.T.I. at Bombay. The Working Group recommended that efforts may be made to secure further foreign assistance both in the form of equipment and experts for the other four proposed institutes.

XXI. MAXIMUM UTILIZATION OF TRAINING ESTABLISHMENTS UNDER GOVERNMENT DEPARTMENTS.

126. The Working Group recommend that the training establishments under the Government Departments like Defence, Railways etc., should be utilised, as far as possible, to train craftsmen for other industries both on a full time and a part-time basis according to a scheme to be worked out by the D.G.E. and T in consultation with the Ministries concerned.

CHAPTER VIII

FINANCIAL PROVISION FOR THE DEVELOPMENT OF TECHNICAL EDUCATION AND VOCATIONAL TRAINING IN THE THIRD FIVE YEAR PLAN

(i) Degree and Diploma Courses and other programmes under the Ministry of S. R. & C. A.

127. It has been stated in earlier Chapters that large-scale expansion of facilities for Technical Education has taken place during the Second Plan in order that the likely demand for engineering graduates and diploma holders for the Third Plan would be adequately met. It was not, however, possible to provide fully for these programmes in the Second Plan. Further major expansion took place only two years after the Plan had started and planning the development of some of the technical institutions took time. This has meant a considerable over-flow of expenditure on these programmes from the Second to the Third Plan, which in the view of the Working Group was the first claim on the resources available for Technical Education in the Third Five Year Plan. These consolidation programmes are directly related to the qualitative improvement of training of engineers and technicians. Some of the major development programmes are briefly described in the following paragraphs.

128. The Indian Institutes of Technology at Bombay and Madras have already started functioning and the one at Kanpur is likely to be started in 1960-61. It is proposed that during the Third Five Year Plan these institutions should be brought to a level which would, more or less, be the same as would be attained by the Indian Institute of Technology at Kharagpur at the end of the Second Five Year Plan. With the experience gained both at Kharagpur and at Bombay it is expected that an expenditure of a bigger order would be possible at these institutions. The College of Engineering and Technology at Delhi will be set up as a fully residential Institute which would provide for a total enrolment of 250 students in the 5-year integrated under-graduate course and about 250 students in post-graduate classes. The completion of the buildings for the Delhi Polytechnic and the development of the different faculties in the Indian Institute of Technology, Kharagpur, and the Indian School of Mines and Applied Geology, Dhanband, are also envisaged during the Third Plan. These Central institutions are estimated to cost roughly Rs. 25.5 crores in the Third Plan period.

129. The Practical Training Stipend Scheme would be extended in the Third Plan to meet the larger out-turn of graduates and diploma holders by securing additional places and stipends. It is expected that by 1965-66 about 2800 and 2050 places would be available for the practical training of graduates and diploma holders respectively which would cover about 25 p.c. of the graduates and 12½ p.c. of the diploma holders passing out of Technical Institutions

at the end of the Third Five Year Plan. In the field of minig, practical training of 18 months' duration would be arranged for all the graduates turned out in the Third Plan. These facilities would improve if the contribution from the industrial establishments, both in the private and public sectors, also increased. It is also proposed to provide for an additional 400 research scholarships and 80 fellowships under the research training programme of the Ministry of SR & CA. The programmes for the award of Senior and Junior Fellowships for training of degree and diploma holders in engineering and technology for teaching positions in Technical Institutions will be continued in the Third Plan with a total number of 400 and 305 Senior and Junior Fellowships respectively. The provision required for these programmes is Rs. 4 crores.

130. In the Second Five Year Plan provision had been made for the establishment of 3 specialised institutions of which only the Administrative Staff College at Hyderabad could be started during the Plan period. It is, therefore, necessary to include in the Third Plan the provision required for the establishment of the other two, viz., Central Institute of Printing and the Central Institute of Management. These Central projects are estimated to need a provision of about Rs. 50 lakhs only.

131. It has been emphasised by the Working Group that one of the ways to improve the staffing position in engineering institutions would be to revise the pay-scales of teachers on the lines recommended by the All India Council for Technical Education. It was also observed that wherever the revised scales had been introduced, there was less difficulty in recruiting teachers and retaining them. Adequate provision, therefore, needs to be made in the Third Plan to meet the additional cost on this account. The Government of India have agreed to meet the entire additional cost for this for a period of 5 years, from the year of implementation and review the position later.

132. The schemes for the expansion of facilities in selected institutions, initiated during the Second Plan on the recommendations of the Ghosh-Chandrakant Committee, and the establishment of 8 Regional Engineering Colleges and 27 Polytechnics would need about Rs. 30 crores in the Third Plan so that the minimum facilities are made available in these institutions as recommended by the All India Council for Technical Education. This provision would also include the amount required for the construction of students' hostels to an extent of 50% in non-residential institutions and 100% in residential ones included under these schemes. The completion of the establishment of new engineering colleges and polytechnics which were approved in the Second Plan both under the Government and the private agencies would, it is estimated, need about Rs. 10 crores during the Third Five Year Plan. In order to continue the policy of the Government to provide for hostel accommodation to 50% of the students on an average in technical institutions and keeping in view the fact that a number of institutions would have changed over to the pattern of 5-year Integrated Course adding thereby to the total student body, about Rs. 6.92 crores may be needed as loans for constructing of students' hostels.

133. Among the various schemes implemented by the States under the Second Plan about 66 Junior Technical Schools were proposed to be started of which about 25 are expected to come up by the end of the Plan. In order to provide for the spill-over expenditure on these institutions and also to start 100 new Junior Technical Schools as adjuncts to polytechnics as recommended by the Vishnu Sahai Committee, a provision of Rs. 10 crores is recommended. Moreover, provision has to be made in the State plans for meeting the additional cost in changing over to the 5-year integrated course. Further it is expected that the recommendations of the Sri Ram Committee appointed by the AICTE in regard to the revision of the equipment lists for engineering colleges and polytechnics would be implemented during the Third Plan period and that financial assistance may have to be given to institutions to meet the increased cost of equipment. Also the Working Group recommended that adequate provision should be made for the replacement of obsolete equipment in some of the older institutions. There are also institutions now being assisted by the AICTE for courses in Architecture, Commerce and Tele-communication at the diploma level and these institutions may have to be assisted during the Third Plan for bringing up the equipment and other facilities to the minimum standard laid down by the AICTE. All these programmes are estimated to cost about Rs. 77 crores.

134. As has been stated earlier, the Government of India have appointed an Expert Committee to look into the question of development of post-graduate studies in engineering and technology. A provision of Rs. 4 crores has been tentatively included for implementing recommendations in this behalf which will be reviewed after the recommendations are made available. This is, however, exclusive of the provision for post-graduate studies in the Central institutions which have been included in the outlay for such institutions separately.

135. It would be seen that for the continuation of programmes already initiated in the Second Five Year Plan and the implementation of policy already decided upon, an amount of Rs. 111 crores would be needed in the Third Five Year Plan. In addition, the Working Group recommended that the intake capacity in Engineering Colleges and Polytechnics should be increased by 5,000 and 10,00 respectively during the Third Plan. Recommendations have also been made for organising part-time courses and correspondence courses for the National Diploma and National Certificates. Four Teachers' Training Colleges have been recommended to be set up for technical teachers in Polytechnics and Secondary Schools. The Working Group has also urged the need for the institution of a large number of merit and loan scholarships so that nearly 50% of the students would be benefited by the assistance. In order to improve the staffing position in technical institutions it was also considered desirable to provide staff quarters at least on a limited scale to begin with. It is proposed that residential accommodation may be provided to about 20% of teachers in Engineering Colleges and Polytechnics in the Third Plan. It is estimated that in order to implement these additional programmes in the way indicated above a total outlay of Rs. 90 crores would be required.

136. It will be seen from the above calculations which were worked out in detail by the Committee for the purpose, after going through the existing cost pattern and the per capita expenditure for an engineering student (which was estimated to be about Rs. 1,200 per annum recurring and about Rs. 7 to 8 thousands capital) that a total provision of Rs. 201 crores, (Rs. 111 crores for continuation schemes and Rs. 90 crores for new programmes) would be desirable. It was, however, noted that some of these programmes would be phased over a period of 5 years and more and the expenditure in the Third Plan would be reduced, leaving some spill-over for the Fourth Plan. Moreover, further consideration was given to the question of economy that had to be introduced in the construction programmes such as, hostels, staff quarters and the amounts to be provided for scholarships if sufficient funds were not available. Three different exercises, therefore, were worked out which are summed up in the following table; the first column indicating the programmes for Rs. 201 crores, the second column for Rs. 130 crores (with reduced amount for building programmes, hostels, staff quarters and scholarships) and the third for Rs. 177 crores on the basis of a phased programme during the Third Plan with a spill-over of about 24 crores for the Fourth Plan. In the third calculation some more provision has been indicated for increase in admissions during the Third Plan with a view to seeing that mechanical, electrical, metallurgical engineers and technicians of special categories are increased in numbers the cost for whom, per capita is larger than global cost assumed in the other calculations of estimates of outlay.

TABLE 18

Provision of financial allocation for technical education in the Third Plan.
(Schemes within the purview of the Ministry of SR&CA).

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(Rs. in crores)

S. No.	Schemes	outlay in		
		201 crores	130 crores	177 crores
I	2	3	4	5
		I	II	III
I. Continuation Programmes.				
1.	Indian School of Mines & Applied Geology, Dhanbad	0.38	0.38	0.68
2.	College of Engineering & Technology, Delhi	3.00	3.13	2.83
3.	Delhi Polytechnic, Delhi	0.60		
4.	Indian Institute of Technology, Kharagpur	2.50	2.50	3.00
5.	Indian Institutes of Technology, Bombay, Madras and Kanpur	19.00	18.25	18.50
6.	Specialised institutions	0.50	0.50	0.50

I	2	3	4	5
		I	II	III
7.	Practical training stipends & provision of hostels for trainees	1.92	1.92	1.92
8.	Research training scholarships & fellowships	0.32	0.32	0.32
9.	Teacher training fellowships & provisions of hostels for the trainees	1.78	1.78	1.78
10.	(a) Centrally sponsored 8 engineering colleges	13.14	11.50	11.50
	(b) Centrally sponsored 27 polytechnics	11.49	10.20	10.00
11.	Expansion of facilities in selected institutions initiated in the Second Plan	5.00	3.75	5.00
12.	Development of non-Govt. institutions	3.50	3.50	3.50
13.	Revision of salary scales of teachers in technical institutions	9.00	4.00	9.00
14.	Loans for construction of students' hostels	6.92	3.00	6.92
15.	(a) Development of Govt. engineering colleges and polytechnics	6.00	6.00	6.00
	(b) Junior Technical schools	10.00	6.00	7.50
16.	Introduction of five-year integrated degree courses in engineering/technology	3.00	3.00	3.00
17.	Increase in price & replacement of obsolete equipment	7.80	5.00	7.80
18.	Development of courses in architecture, metallurgy, tele-communication at diploma level started in Second Plan	1.00	1.00	1.00
19.	Post-Graduate courses & Research	4.20	4.20	4.20
	TOTAL FOR CONTINUATION PROGRAMMES	111.11	89.93	104.95
II. New Programmes:				
20.	(a) Increase in admission for Degree courses during the Third Plan	27.64	14.28	20.00
	(b) Increase in admission for Diploma courses	23.19	10.63	20.00
21.	Part-time and correspondence courses etc.	2.89	2.89	1.50
22.	Training Colleges for teachers in polytechnics etc.	0.60	0.60	0.60
23.	Staff Quarters	5.20	1.00	5.20
24.	Deficit recurring grant-in-aid to non-Govt. institutions	5.60	..(a)	..(a)
25.	Scholarships	24.64	11.00	24.64
	TOTAL FOR NEW PROGRAMMES	89.76	40.40	71.94
	GRAND TOTAL	200.87	130.33	176.89
	(Say)	201	130	177

(a) Scheme 24 above. No provision is indicated under II & III as it was thought it might be better to consider this as a committed non-development expenditure.

(ii) *Training of craftsmen and other programmes under the DGRE.*

137. As already explained the additional requirements of craftsmen during the Third Five Year Plan were estimated at 11-13 lakhs. These estimates included craftsmen in non-engineering trades for which the traditional method of training in the family predominates. It was, therefore, felt that an attempt may be made to find out how many out of the above 13 lakhs would relate to the engineering trades like machinists, turners, fitters, etc., as the training in engineering trades could be separately categorised from training in other skills. If facilities for institutional training were, for various reasons limited they could first be directed towards these engineering trades. It has been already stated in chapter VI that additional number of craftsmen in the engineering trades required during the Third Five Year Plan would be of the order of 7.5 lakhs, both for the additional development envisaged in the Third Plan and the normal replacement of the skilled labour force. -

138. An attempt to study the total number of skilled craftsmen in the age of 15-24 in order to estimate the requirements of training facilities in the industrial Training Institutes of the DG E and T during the Third Five Year Plan was made and it would appear that facilities to train about 3 lakhs of persons in the institutes may be made during the Third Five Year Plan for the engineering and building trades. Of these, it is estimated that nearly 1 lakh of craftsmen would be trained by the non-DG E and T industrial and trade schools so that facilities for training about 2 lakhs of craftsmen will have to be provided both in the industrial training institutes and by apprenticeship in factories under the programmes sponsored by the DG E and T.

139. It was also noted that consequent to the implementation of the recommendations of the Advani Committee, the DG E and T had to defer their programmes for construction of hostels and staff quarters from the Second to the Third Five Year Plan so that their training programme during the second plan would nearly be doubled. The Committee of the Working Group had also recommended that scholarships should be awarded to a total of 50% of the enrolled students in the Industrial Training Institutes as against 33-1/3% catered to during the Second Five Year Plan. It was also noted that the salary scales of instructors in the I.T.Is had been recommended for an upward revision. It is expected that all the State Governments would start implementing these revised scales during the Third Five Year Plan. Taking all these factors into consideration, a plan for Rs. 84.15 crores has been proposed for the Third Five Year Plan, which includes the creation of an additional 1 lakh of seats for craftsmen training in the Institutes and 14,000 seats for the National Apprenticeship Scheme. The scheme for Evening Classes for industrial workers is being continued in the Third Five Year Plan to provide for a total of 12,000 seats. The Central Training Institutes for instructors (for men and women) would be strengthened to train a total number of 12600 instructors during the Third Plan period. This does not, however, include any provision for the scheme "training of handicapped" as the proposal is under the consideration of the Ministry of Education. In regard to the scheme for the "training of educated unemployed in Work and Orientation

Centres" the provision has to be made for spill-over expenditure on this account the exact amount for which is not available. The scheme was initiated in the second Plan purely as an experimental measure and further expansion would depend on an assessment of the programme so far implemented. Provision has also to be made for the re-organisation of the Training Centres under the State Departments of Commerce and Industry and for upgrading the skill of those who are pursuing the trades and need supplementary training in technical and other related subjects for being better suited for the jobs. These programmes will be implemented under the auspices of the National Council for Training in Vocational Trades.

140. With a view to making the fullest use of equipment and buildings, all the training institutes have been working in double shift. Creation of additional facilities even in the existing institutes would, therefore, require additional accommodation, additional equipment and additional staff. Taking into consideration all these factors and, particularly the fact that the employment opportunities would be progressively created during the Third Five Year Plan, it is proposed to create additional facilities for increasing the capacity of institutional training in the following way:

Years	Additional seats	Remarks
1961-62	5,000	Creating additional facilities in the existing institutes.
1962-63	15,000	
1963-64	30,000	Additional facilities for 20,000 in existing institutes & 10,000 in new institutes.
1964-65	30,000	Facilities in new institutes.
1965-66	20,000	10,000 in new institutes and 10,000 by creating additional facilities in private institutions.

If, however, it is found during the first year of the Third Five Year Plan, that the proposed provision will not be adequate and that it has to be stepped up by 2 or 3 times, the plan could be rearranged in such a way as to provide for a very large expansion even from the second year of the plan period. From the point of view of employment it would be advantageous to proceed slowly in this respect at least in the beginning. A statement showing the schemes, and total outlay proposed for the Third Five Year Plan under the DGE and T is given below:—

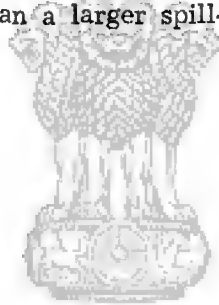
TABLE 19.—*Provision of financial allocation for Vocational Training in III Plan (Schemes within the purview of the D.G.E and T in the Ministry of L. & E.)*

(Rs. in crores).

Scheme No.	Name of Scheme	Estimated Total outlay
1	2	3
1	Craftsmen Training Institutes	71.05
2	National Apprenticeship Scheme	

1	2	3
3	Evening Classes for Industrial Workers	1.82
4	Central Training Institutes for Instructors (Men and Women). .	6.40
5	Additional Headquarters Staff	0.19
6	Strengthening of the State Directorates of Training	0.10
7	Training of Handicapped & Educated Unemployed etc. etc. . . .	N. A.
8	Consequent on the recommendations to increase the number of scholarships to 50% of the trainees the extra expenditure for 1,00,000 additional seats on this account in the 3rd Plan. . . .	2.49
TOTAL		84.15

141. It will be seen from the above statement that a provision of Rs. 84.15 crores will be required for these programmes. However, it is understood that economy in construction of teaching blocks & hostels is being considered by a Committee of National Council for Training in Vocational Trades. The capital expenditure out of Rs. 84.15 crores is estimated to be about 58 crores and any reduction in this provision will mean a larger spill-over in the fourth plan.



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CHAPTER IX

QUALITATIVE IMPROVEMENT OF INSTITUTIONS

142. The various suggestions made by the Working Group in respect of development of Technical Education and Vocational Training in the Third and Fourth Plans have already been stated in Chapter VII. Special data was collected and papers prepared on three important problems in this connection viz., (i) teaching personnel, (ii) supply of equipment and (iii) "wastage" during training. The following paragraphs bring out certain aspects of these three questions.

(i) *Teaching personnel.*

(a) *A study of shortages:*

143. In pursuance of the recommendation made by the Committee on Diploma and Degree courses of the Working Group, a questionnaire was issued to all engineering colleges and polytechnics in order to find out the shortage of staff, if any, and the difficulties in securing equipment, teacher-pupil ratio etc. in these institutions. The data available from 30 degree colleges and 61 Polytechnics which was considered as representative sample was further analysed and interpreted. The replies from other institutions were not considered because they were either incomplete or considerably delayed. From the information received the supply position of teachers is indicated in the following table:

TABLE 20—*Teaching Staff in technical institutions.*

Stage	No. of institutions studied.	Staff		Percentage shortage.
		Sanctioned strength	Actual strength	
Degree	30	1630	1101	32.5
Diploma	61	1537	1158	24.5

144. The region-wise staff position has been summarised in the following table:

TABLE 21

Region	Sanctioned strength	Actual Strength	Col. 3 as % age of Col. 2.	Rank
(1)	(2)	(3)	(4)	(5)
<i>Degree Institutions</i>				
Western	305	224	73.4	1
Southern	412	292	70.9	2
Northern	381	258	67.7	3
Eastern	532	327	61.4	4
<i>Diploma Institutions.</i>				
Eastern	399	313	78.0	1
Northern	445	332	74.6	2
Southern	520	386	74.2	3
Western	173	127	73.4	4

One interesting point to note is that while in the case of Western Region a better percentage of teaching staff was available in degree institutions against a smaller percentage in the diploma institutions, in the Eastern Region the position was reverse. It was also noticed that in the case of degree institutions, the variation in the percentage supply position was much higher than in the case of diploma institutions.

145. Another point of interest revealed by the study was that shortage was particularly felt in the category of lecturers in colleges and the vice principals/Heads of Departments of the polytechnics. The teaching personnel at the higher level and lower level, i.e., Assistant Lecturers, Demonstrators etc. were normally available. This is illustrated by the following table:—

TABLE 22.

Teaching staff in technical institutions 1959-60.

(i) *Degree Institutions*

Region	Sanctioned Strength					Actual strength					
	Principal.	Head Deptt.	Lecturer	Instructor Demonstrator.	Total	Principal.	Head of Deptt.	Lecturer.	Instructor.	Total	
1	2	3	4	5	6	7	8	9	10	11	
Northern	.	8	30	297	46	381	7	22	195	34	258
Eastern .	.	7	25	375	125	532	6	17	215	89	327
Western	.	6	32	224	43	305	6	24	154	40	224
Southern	.	9	27	279	97	412	9	18	181	84	292
		30	114	1175	311	1630	28	81	745	247	1101
Percentages: columns.											
	7 of 2	8 of 3	9 of 4	10 of 5	11 of 6.						
	(12)	(13)	(14)	(15)	(16)						
	87.5	73.3	65.7	46.9	67.7						
	86.0	68.0	57.6	71.2	61.4						
	100.0	75.0	68.7	93.0	73.4						
	100.0	66.6	65.0	86.6	70.9						
	93.3	71.1	63.4	79.4	67.5						

*Teaching staff in technical institutions 1959-60.**(ii) Diploma Institutions*

Region	Sanctioned Strength					Total	Actual Strength				Total	
	Prin- cipal.	Head of Deptt.	Lectu- rer	Ins- tructor Demo- nstra- tor.	Princi- pal.		Head of Deptt.	Lectu- rer.	Ins- tructor.			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)		
Northern	.	.	14	34	142	255	445	14	18	110	190	332
Eastern	.	.	16	12	197	174	399	15	12	141	145	313
Western	.	.	9	9	82	73	173	8	7	56	56	127
Southern	.	.	22	48	252	198	520	21	32	195	138	386
TOTAL	.	.	61	103	673	700	1537	58	69	502	529	1158

Percentages Columns

7 of 2 8 of 3 9 of 4 10 of 5 11 of 6

(12) (13) (14) (15) (16)

100.0 53.0 77.5 74.5 74.6

93.8 100.0 77.6 80.9 78.0

88.9 77.8 68.3 76.7 73.4

95.5 66.6 77.4 70.0 74.2

95.1 67.0 74.6 75.6 75.4

146. The Institutions were requested to indicate whether they considered it necessary that their teaching staff should be trained in educational practice. A scrutiny of the responses reveals that about 57% of the degree institutions and about 66% of the diploma institutions have emphasised that some sort of training was desirable for the teachers of technical institutions. Regarding the forms of training 60% of the responding institutions of degree level and 65% of the diploma level suggested the organisation of refresher courses during the summer vacation.

147. The Working Group on Technical Education considered the various steps that need to be taken to augment the supply of teachers. The recommendations made by the conference of Heads of Technical Institutions and the decisions of the A.I.C.T.E. as well as recently established training colleges in the U.K. were noted. As already stated the Working Group recommended establishment of two or more training colleges for technical teachers of the polytechnics and secondary schools.

(c) *Teacher-pupil Ratio :*

148. The position revealed from the responses to the questionnaire regarding teacher-pupil ratio is as follows:—

About 31% of the degree institutions that have responded have indicated teacher-pupil ratio of 1:10. Another 38.5% of the institutions have a ratio of 1:15 and the rest have about 1:20. So far as the diploma institutions are concerned about 69% of the institutions have indicated a teacher-pupil ratio of 1:15. Out of the 48 institutions that have supplied information 9 have indicated a teacher-pupil ratio of 1:5. It however, appears that by and large these institutions have been established recently and have not attained their normal size. About 31% of the institutions of diploma level that have responded to the questionnaire have a teacher-pupil ratio of 1:20 and above.

149. It may be mentioned that the All India Council for Technical Education have recommended the teacher-pupil ratio of 1:10 for degree institutions and 1:15 for diploma institutions. Judged from this criterion only about 31% of institutions of degree level come up to the standard, while the corresponding percentage for diploma institutions is about 69. Qualitative improvement of technical education in the III Plan would largely depend on attempts directed towards a better pupil teacher ratio.

(d) *Requirements of teaching personnel during the Third Plan.*

150. In order to estimate the requirements of teaching personnel in respect of institutions of diploma and degree levels during the Third Five Year Plan period, calculations have to be made under the following heads:—

- (i) Shortage in respect of teaching personnel by the end of the Second Five Year Plan. It would be noted that as indicated in paragraph 143 above, the percentage shortage of teachers of degree and diploma levels respectively as revealed from the study undertaken in the Education Division is 32.5 and 24.5;
- (ii) depletion of staff on account of normal replacement i.e. due to mortality, retirements etc. This has been calculated at 3% per annum of the staff in position by the end of the second plan;
- (iii) additional requirements on account of the likely increase in the enrolment capacity of the technical institutions in the country.

151. The following table indicates the shortage in the teaching staff and the likely strength of the staff by 1960-61.

TABLE 23.

Branch-wise enrolment in technical institutions and teachers in 1955-56; likely position in 1960-61.

Branch	Teachers in 1955-56*				Estimated Enrolment in 1960-61		Teachers in 1960-61@	
	Degree	% age of Total	Diploma	% age of Total	Degree	Diploma	Degree	Diploma
1	2	3	4	5	6	7	8	9
Civil	719	38.5	977	52.8	14359	29450	1435	1963
Mechanical	514	27.5	291	15.7	11487	15395	1149	1026
Electrical	398	21.3	302	16.3	11487	14725	1149	982
Others	237	12.7	281	15.2	10531	7362	1053	491
Grand Total	1868	100.0	1851	100.0	47864	66932	4786	4462

Shortages of teachers in 1960-61		Teachers in 1960-61 (likely position).	
Degree	Diploma	Degree	Diploma
(10)	(11)	(12)	(13)
191	184	1244	1779
260	497	889	529
461	433	688	512
643	(-)-21	410	512
1555	1093	3231	3369

Requirements as a result of additional intake capacity.

152. It has been proposed that the intake capacity of the degree institutions should be raised from 13,500 in 1960-61 to about 20,000 in 1965-66 out of which 1500 to 2000 would be trained through part-time and correspondence courses. For the diploma institutions the intake capacity is proposed to be raised from 25,000 in 1960-61 to about 42500-45,000 in 1965-66 including 7500 to 10,000 through the other methods of training like part-time courses.

153. For the calculation of teacher requirements in the third Plan an additional intake capacity of 6000 for degree courses and 15,000 for diploma courses could be taken as a reasonable estimates. The additional requirements in respect of teachers have to be calculated on the basis of the teacher-pupil ratio of 1:10 for degree institutions and 1:15 for diploma institutions as recommended by

*Source : Perspective Planning Division Study No. 5 "Engineers in India—1955-56"

@ Calculated on the basis of Teacher-pupil ratio of 1 : 10 for degree institutions and 1:15 for diploma institutions as recommended by the A.I.C.T.E.

the All India Council for Technical Education. To this has to be added the additional requirements on account of normal replacement etc. at the rate of 3 per cent per annum as explained above.

154. The following table gives estimates of the requirements of teachers in the third Plan:

TABLE 24.

Courses	Estimated Enrolment* (1965-66)		Teachers Requirements in (1965-66)		Teachers in position	
	Degree Classes	Diploma Classes	Degree Classes	Diploma Classes	Degree**	Diploma***
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Civil . . .	22200	50600	2220	3373	1244	1779
Mechanical . .	17760	26450	1776	1763	889	529
Electrical . .	17760	25300	1776	1687	688	549
Others . . .	16280	12650	1628	843	410	512
TOTAL .	74000	115000	7400	7666	3231	3369

Courses	Additional teacher requirements due to expansion envisaged in the Third Plan.		Additional requirements on account of normal replacements @		Total additional requirements (1961-66)	
	Degree	Diploma	Degree	Diploma	Degree	Diploma
(8)	(9)	(10)	(11)	(12)	(13)	(14)
Civil . . .	976	1594	187	267	1163	1861
Mechanical . .	887	1234	133	79	1020	1313
Electrical . .	1088	1138	103	82	1191	1220
Others . . .	1218	331	62	77	1280	408
TOTAL .	4169	4297	485	505	4654	4802

*The ratio between the branch-wise distribution has been assumed to be the same as likely to exist in 1960-61.

Col. 12 of table 23. * Col. 13 of Table 23.

@It has been assumed that there will be negligible depletion of teachers recruited during the third Plan period on account of retirement etc.

155. The requirements of additional teachers qualification-wise on the assumption that 50% of the teaching posts in diploma institutions should be held by teachers with degree qualifications in engineering and technology, would be as follows:

TABLE 25.

Additional teacher requirements according to qualifications

Category	Additional teacher requirements for		
	Degree Classes	Diploma Classes	Total
1. Degree Holders	4654	2401	7055
2. Diploma Holders	—	2401	2401
TOTAL	4654	4802	9456

(ii) *Provision of Equipment*

156. The technical institutions were requested to finish information regarding the adequacy or otherwise of the equipment available with them as also the difficulties faced by them in its procurement. Replies received from 35 degree and 65 diploma institutions have been selected for further analysis.

157. The position about the adequacy or otherwise of the equipment for the present needs of the technical institutions of degree level is summarised in the table below:

TABLE 26.

Region	Total No. of institutions responding			No. of institutions having adequate equipment			Percentages			
	Govt.	Non-Govt.	Total	Govt.	Non-Govt.	Total	Col. 5 as % of 2	Col. 6 as % of 3	Col. 7 as % of 4	
I	2	3	4	5	6	7	8	9	10	
Northern Region	1	8	9	1	2	3	100	25	33	
Eastern Region	3	6	9	0	5	5	0	85	55	
Western Region	2	4	6	1	2	3	50	50	50	
Southern Region	4	7	11	2	0	2	50	0	18	
TOTAL	10	25	35	4	9	13	40	36	37	

It would be seen that taking the country as a whole, a little more than one third of the institutions under study have indicated that they have adequate equipment for their present needs. So far as

the region-wise position is concerned, while the Eastern, and Western Regions are fairly above the all-India percentage, the Southern Region indicates a much lower percentage, i.e. 18. The position of Northern Region, although somewhat better than the southern, is also disquieting.

158. On the whole the position of Government institutions appears to be slightly better than the non-Government institutions although the position of Government institutions in the Eastern Region is far worse. So far as the non-Government institutions are concerned, the Eastern Region appears to be well placed. In the case of Government institutions, in view of the fact that only one institution has responded to the questionnaire, no generalisation can be made.

159. The position in respect of Diploma Institutions is indicated in the following table:

TABLE 27.

Region	Total No. of Institutions responding		Total	No. of institutions having adequate equipment		Total	Percent				
	Govt.	Non-Govt.		Govt.	Non-Govt.		Col. 5 as % of 2	Col. 6 as % of 3	Col. 7 as % of 4.		
	1	2	3	4	5	6	7	8	9	10	
Northern Region	.	.	4	10	14	1	4	5	25	40	35
Eastern Region.	.	.	11	5	16	3	1	4	27	20	25
Western Region	.	.	7	2	9	4	1	5	56	50	55
Southern Region	.	.	10	16	26	1	3	4	10	25	16
TOTAL	.	.	32	33	65	9	9	18	28	27	28

As compared to degree institutions the position of diploma institutions appears to be somewhat worse. In the case of degree institutions 37% of the institutions were claiming to have adequate equipment for their present needs while the corresponding percentage for diploma institutions is only 28. So far as the Government and non-Government institutions are concerned, the scales appear to be evenly balanced. The Government institutions, however, indicate a little improvement as compared to the non-Government institutions but the difference is not significant. Further, the Southern Region appears to be badly placed as compared to the Western Region which indicates a much better position. It would also be seen that the position of Government institutions in the Southern Region is unsatisfactory in that only 10% of Government institutions are reported to be having what may be called adequate equipment. The same may be said of the non-Government institutions in the Eastern Region.

160. A perusal of the replies received from the degree institutions revealed that by and large the equipment available with them would not be adequate for their development programmes to be undertaken during the Third Plan period. The position of the diploma institutions is also the same as that of degree institutions if not somewhat worse.

(b) Difficulties in procurement of equipment:

161. The various difficulties faced by the institutions in the procurement of equipment for their needs have been summarised in the table below:

TABLE 28

Difficulties experienced	Total responses (Degree & Diploma institutions)	% age of the total
(i) Import restrictions and foreign exchange	74	66.1
(ii) Ceiling Cost fixed by the All India Council for Technical Education below the market rates	17	15.2
(iii) Lack of funds	4	3.5
(iv) No reply	17	15.2
	112	100.0

It would appear that the main difficulty experienced by the technical institutions is in relation to import restrictions and foreign exchange difficulties. However as stated in Chapter VII para 99 the idea is to encourage indigenous production of equipment which will remove this difficulty in good many cases. The next in rank order come the difficulties on account of the below the market price quoted in the Model List approved by the All India Council for Technical Education. In the case of a few non-Governmental institutions lack of funds has also been reported and in one institution lack of floor space has been mentioned as the cause of inadequate equipment.

162. It was noted that the Model List prepared by the All India Council for Technical Education is being revised and it is hoped that the difficulties experienced in this regard by the institutions would be reduced to a very great extent.

(iii) Wastage in Technical Institutions:

163. The extent of wastage occurring in the degree and diploma institutions can be broadly assessed by finding out the number of candidates who either dropped out or failed in the examination out of those who got admission in a particular year. In the case of degree holders a rough and ready method would be to compare the out turn with the intake of four years earlier presuming that the

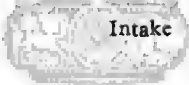
degree course is of four years duration and that there has been little stagnation. This is indicated below:

TABLE 29.—*Year-wise position about the percentage of out-turn to intake during 1950-54 in degree courses in engineering and technology.*

Year						Intake	Year	Out-turn	(4) as % age of (2)
1						2	3	4	5
1950	.	.	.	.	.	4,119	1954	3,207	77.8
1951	.	.	.	.	.	4,888	1955	4,017	82.2
1952	.	.	.	.	.	5,184	1956	4,293	82.8
1953	.	.	.	.	.	5,450	1957	4,290	78.7
1954	.	.	.	.	.	5,468	1958	4,665	85.3
TOTAL						25,109		20,472	81.1

From the above table it will be observed that during the period 1950-54, the total intake was 25,109 and the out-turn was only 20,472 which in other words means an average wastage of 18.9 per cent. In the case of diploma institutions out of an intake of 37,638 the total out-turn was 22,923 signifying a wastage of 39%. The following table explains the position:

TABLE 30.—*Year-wise position about the percentage of out-turn to intake during 1951-55 in diploma courses in engineering and technology.*

Year								Intake	Year	Out-turn	Col. 4 as % age of Col. 2
1							2	3	4	5	
1951	.	.	.	.	.	.	6,216	1954	3,397	54.6
1952	.	.	.	.	.	.	6,499	1955	4,072	62.7
1953	.	.	.	.	.	.	7,213	1956	4,075	56.5
1954	.	.	.	.	.	.	8,313	1957	5,034	60.6
1955	.	.	.	.	.	.	9,397	1958	6,345	67.5
TOTAL .							37,638		22,923	61.0	

164. The Perspective Planning Division of the Planning Commission, in their Preliminary Report on Wastage in Technical Education (Manpower Studies No. 13) also made an attempt to analyse the problem. After examining fresh admissions of 6798 in degree courses and 9790 in diploma courses in engineering the percentage of wastage noted respectively was 19.6 and 35.6. This is more or less corroborated by the figures indicated in the above tables though the figures in the tables relate to both engineering and technology. The Perspective Planning Division study gives

the total wastage figures, under various courses with different durations, which are summarised in the table below:

TABLE 31

(a) *Degree*

Courses	Admission	Wastage	% age of wastage
1	2	3	4
Civil	1109	227	20.5
Electrical	158	29	18.4
Mechanical	268	43	16.0
Others	5263	1033	19.6
TOTAL	6798	1332	19.6

(b) *Diploma*

Courses	Admission	Wastage	% age of wastage
1	2	3	4
Civil	3524	700	19.9
Electrical	1005	560	55.7
Mechanical	664	276	41.6
Others	4597	1950	42.4
TOTAL	9790	3486	35.6

In degree courses the highest incidence of wastage is under civil engineering and in the diploma courses the wastage is acute in electrical, mechanical and other engineering courses.

165. In degree courses, nearly two thirds of the wastage could be accounted for by the students who fail in the examinations in the first or first two years of the course and discontinue thereafter. The remaining one third is due to the discontinuance of the courses by the students for various reasons which may not be connected with their inability to cope with the course. According to the Perspective Planning Division study between 40 to 50 per cent of the students going in for 3 to 4 years course complete the course successfully in the period prescribed, another 40 to 50 per cent take one or two years more. In the three year courses, the stagnation rate, however, is about 20 per cent.

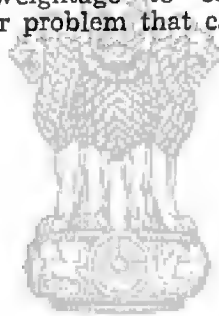
166. The analysis further indicates the following reasons for the wastage:

(a) Some students have inadequate financial means and leave the course within a year of joining. A large number of students get admitted in the hope of getting financial assistance from the Central and State Governments. Even when the scholarships are made available, these may be insufficient in number and inadequate in amount.

(b) Some students find it difficult to cope with the courses after joining the institutes, either because of lack of aptitude for the theoretical and exacting practical work or because of the heaviness of the course about which they were not advised before joining. Moreover merit for purposes of admission into the engineering and technical institutions is often judged from different angles in different institutions. In some cases admission are determined entirely on the basis of marks obtained in the qualifying examination plus the candidates' performance at an interview. In a number of States the policy of reservation of a large percentage of seats for some of the backward classes even with the lower academic attainments tends often to reduce the number of successful candidates coming out of institutions.

(c) A number of students abandon the engineering course after getting admission in other institutions of professional courses. It is suggested that in order to overcome this difficulty, a waiting list of candidate's seeking admission should be maintained so that the students could be drawn from it whenever it is required.

(d) Reform in the existing system of examination by giving suitable emphasis and weightage to competence in practical and sessional work is another problem that calls for examination by an expert body.



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CHAPTER X

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

CHAPTER II.—*Technical Education and the problem of manpower*

Manpower Studies have to be undertaken to consider shortages of Scientific and Technical Manpower felt during the recent years.
(Paras 8 to 11).

2. Scientific and Technical Personnel must be increased in a much larger proportion for economic development of the country.
(Para 11).

3. The Working Group noted that the Manpower Directorate in the Ministry of Home Affairs has been established with a view to examining the requirements of personnel in advance for projects likely to be established during the future Plan periods and alert Ministries and State Governments in regard to advanced training arrangements for the purpose.
(Para 15).

4. Shortage of Manpower would result in serious bottle-necks in the national economy and while estimating requirements of technical personnel, sufficient margin should be kept for training more rather than less.
(Para 18).

5. The relationship between power generation and national income per head in 40 countries indicates that Power and Electrical Industries bring with it rise in living standards and demand a much larger technical personnel than normally is calculated.
(Para 18).

CHAPTER III.—*Concept of Technical Education*

6. The National system of Technical Education and Vocational Training must both form a link between education and industry and receive a separate consideration as a form of mental training suited to certain types of intelligence irrespective of their future occupations.
(Para 20).

7. With the spread of universal education up to the age of 14, facilities for Vocational Training on a large scale will have their significant function.
(Para 22).

8. The changing pattern of education and training in relation to technical and scientific changes and in relation to the occupational trends has to be recognised.
(Para 22).

9. The implementation of Scientific Policy Resolution of the Government of India implies emphasis on Scientific and Technological education at all levels.
(Para 22).

10. The basis of Technical Education has to be built up from the school stage by emphasising courses in Science, Mathematics and certain crafts and bias for practical work.
(Para 23).

11. For the advance of Technical and Technological Education and Training at different levels, appropriate action be taken by the State Governments and Central Government to emphasise in the curricular courses, the importance of Scientific Courses and the use of tools and instruments. (Para 24).

CHAPTER IV.—*The scope of Technical Education and Vocational Training:*

12. The problem is to see whether the types of institutions that have been established are adequate for the kinds of personnel referred for handling our development programmes. (Para 44).

13. Industrial and technological development may change the nature of training emphasising certain aspects and bringing into the course of training a larger area and very often a more intensive training in specialised fields. (Para 48).

14. Appropriate bodies like the All India Council for Technical Education, National Council for Training in Vocational Trades and the Ministry of Education, Ministry of Scientific Research and Cultural Affairs and the Ministry of Labour and Employment and Planning Commission may ensure that coordination of efforts is done by different agencies for producing appropriate personnel and secondly, adequate training is provided in different institutions with a view to bringing a dynamic relationship between the out-turn of the institutions and the requirements of industries. (Para 49).

CHAPTER V.—*Present Position*

15. The present position of Engineering Colleges, Polytechnics and Industrial Training Institutes is as follows:

Year	Engineering Colleges		Polytechnics		I. T. Is.	
	No. of institutions	Annual intake	No. of institutions	Annual intake	No. of institutions.	Seating capacity.
1950-51	49	4119	86	5903	..	..
1955-56	64	5937	102	9397	59	10534
1960-61	97	13500	197	25600	143	38444

16. The change in emphasis on Mechanical, Electrical, Mining, Metallurgical and Chemical Engineering etc., will necessitate more seats in Colleges and Polytechnics for these subjects. Appropriate action for the purpose has to be considered. (Para 56).

CHAPTER VI.—*Assessment of Demand and Supply of the Engineering Personnel during the Third and Fourth Plans.*

17. If appropriate steps are taken in the Third Plan for providing training facilities the demand and supply position of graduates, dip-

Diploma holders and craftsmen during the Third and Fourth Plan will be as follows:

	Second Plan 1956-61		Third Plan 1961-66		Fourth Plan 1966-71	
	Demand	Supply	Demand	Supply	Demand	Supply
Graduate . . .	28,000	26,000	45,000	51,000	75,000	75,275
Diploma holders . .	54,000	32,000	80,000	(b)76,000	1,20,000	1,17,500(d)
Craftsmen . . .	6,35,000	(a)	11,00,000	(c)	(to be estimated in the Third Plan)	

19. According to the calculations given in the Chapter, the proposed expansion of facilities will mean an additional intake of 5,000 in Engineering Colleges and 2,000 for the same course by Part-time and Correspondence Courses; 10,000 in Polytechnics and 5,000 for the same course by Part-time and Correspondence Courses and for Craftsmen Courses 1 lakh of additional seats in the Industrial Training Centres.

19. A. Technical developments which might completely transform the nature of qualitative and quantitative requirements are difficult to forecast. It is recommended that there should be an organisation at the Centre which will coordinate the demand and supply relationship in different Centres periodically in relation to the development for the next 15 to 20 years. This may be achieved through a Committee of representatives of Planning Commission, Directorate of Manpower, Ministry of Home Affairs, Ministry of S.R. & C.A. and a few other Ministries utilising the personnel most.

CHAPTER VII.—*Recommendations for the development of Technical Education and Vocational Training in the Third Plan.*

20. During the large-scale expansion of facilities of the Second Plan, it was noted that institutions had to face difficulties of shortage of teachers and equipment, inadequate buildings and hostel accommodation, the need for some staff quarters resulting in lowering of standards as well as a certain element of wastage of Technical students. (Para 81).

21. It is recommended that the intake capacity of Engineering Colleges and Polytechnics should be gradually increased to an optimum size, subject to the condition that institutions so developed should come up to the prescribed standards and further that the optimum size of an Engineering College should be between 3,000 to 6,000 from the point of view of economy and efficiency. The administrative organization of such an institution should be similar to that of a residential University. It is further recommended that some

(a) This shortage could be met in the Third Plan if necessary.

(b) Institutional training would result in a figure of 40,000 to 50,000 while the rest were available through other forms of training.

(c) 3,00,000 are expected to be available through D.G.R.E. training centres the rest are estimated to be available through other methods.

(d) Shortage will be met through expansion of facilities during the Fourth Plan.

selected Colleges should be so expended in the Third Plan; such expansion of institutions should be considered before establishment of new institutions. (Paras 84 to 88).

22. The *location* of Engineering Colleges as well as Polytechnics should be as near industrial areas as possible; the idea being that practical training as well as training by visits to big industrial concerns would be possible in an industrialised area. Also, part-time teachers from industries with their practical knowledge will be helpful to the institutions only in such an area. (Para 89).

23. Consequent to the industrialisation attempted in the Second Plan, and the setting up of various heavy and medium industrial projects, it is estimated that more mechanical, electrical and chemical engineers and those for Mining, Metallurgy, Petroleum Technology etc., will be required in the Third and successive Plans. (Para 96).

24. *Practical Training* on the basis of the scheme in the Second Plan needs to be further developed and adequate finances for this important programme should be provided in the Third Plan. (Paras 91 to 96).

25. The number of *scholarships* in the Engineering Colleges and Polytechnics should be substantially increased. Delay in award of scholarships should be avoided by delegating powers to the Heads of Institutions in regard to the award of scholarships so that the students are assured of the stipends at the beginning of the term. Provision for *loan scholarships* should be considered as a helpful step for a large percentage of students and a fund for this purpose should be created institution-wise. In the long-run such a fund could itself be self-generating. (Para 97).

26. In order to *harness community effort* to finance scholarships and loan funds schemes for which Government should provide a matching grant of Rs. 1 crore, grants should be made available to the institutions on a matching basis wherever they are able to secure funds from trusts or the community for the purpose. (Para 98).

27. The Working Group commend the Government effort to encourage the manufacture of scientific instruments etc., in the country through a machinery suitable for the purpose and recognise that some *equipment* should be fabricated in the workshops in the institutions themselves. They, however, recommend suitable steps to be taken to see that institutions are properly equipped. (Para 99).

28. Suitable steps should be taken to see that obsolete equipment in some of the older institutions is replaced. (Para 99).

29. Equipment lists prepared some years ago need revision. (Para 99)

30. The suggestions made in regard to *recruitment policy* by Engineering Personnel Committee need implementation. (Para 100)

31. The *new scales of pay* for teachers in Engineering Colleges and Polytechnics recommended by the All India Council for Technical Education should be implemented by all State Governments and private organisation. (Para 100)

32. Expansion of facilities for Technical Education by way of *Sandwich Courses, Part-time and Short-term Courses, Correspondence Courses, Day-release Schemes* etc. should be organised. Concrete schemes should be prepared for this purpose by appropriate Ministries and Technical bodies. (Paras 101 to 105)

33. *Correspondence Courses* should be of special value in imparting instructions to persons already in employment mostly with a view to improving the knowledge and skill in their present employment. A small Committee should examine this question and secure further data in regard to organisations for the purpose in such countries like the U.S.S.R., the U.S.A. and the U.K. by visits if necessary, so that a workable scheme for implementation in the Third Plan is prepared. (Para 105)

34. While application of *apitue tests* for selecting students for admission to Diploma and Degree Courses on a large-scale may not be immediately feasible, and in view of the fact that employment of such tests has in certain cases like Defence Services reduced the wastage in Technical Manpower and also such tests would properly guide the students in their course of study, it is recommended that aptitude tests may be tried by the institutions as an experimental measure and the results carefully watched. (Para 106)

35. *Guidance literature* as well as the publications giving information about the Courses offered in various Engineering Institutions in the country should be made available to students. This is for consideration of the Ministry of S. R. & C. A. (Para 107).

36. Recommendations made in regard to admissions, minimum qualification, relaxation of rules etc. for degree courses may be considered by the Ministry of S. R. & C. A. (Para 108)

37. (a) Some new thinking in regard to the objectives and functions of Polytechnics as established to-day was desirable.

(b) Institutions like Polytechnics may have to be organised on a big scale in big cities and the number of courses to be introduced increased considerably in the same way as, for example, in institutions in the U.K.

(c) A further study of the problem be undertaken with a view to seeing that the polytechnic is established in appropriate relation to our social, educational and economic requirements.

(Paras 109 to 110)

38. It was noted that at present in the Eastern Region the intake capacity is 180 for Polytechnic, while in other Regions it is 120. It is recommended that the All India Council for Technical Education may consider whether the intake capacity should not be uniformly 180 in all the Regions. (Para 110)

39. It was desirable to organise Special Training Courses for teachers in technical subjects required for Polytechnics and secondary schools. It is recommended that the question of setting up of training colleges for the purpose should be considered on an all India basis and Centres established for the purpose. (Para 111)

40. It was noted that the question of augmenting the supply of technical books at reasonable cost was engaging the attention of the Ministry of S. R. & C. A. (Para 112)

41. An organisation of all teachers of engineering to be known as the *Indian Society for Engineering Education* may be brought into existence and Government of India should consider assisting such an organisation. (Para 113)

42. With a view to co-ordinating training courses provided by different institutions under different Ministries and industries and for the purpose of bringing into existence co-ordinated structure of vocational education throughout the country, it is recommended that a sub-committee for co-ordination may be formed under the National Council for Training in Vocational Trades with representatives of concerned Ministries with a Secretariat in a co-ordinating agency like the Planning Commission. (Para 120)

43. *Apprenticeship Training* for craftsmen will be related to the proposed legislation for compulsory apprenticeship in factories under consideration of the Ministry of Labour and Employment. The Working Group recommend that the proposed legislation be expedited to ensure an early implementation of the programmes of apprenticeship training. (Para 121)

44. The recommendation of the Vishnu Sahai Committee that the new *Junior Technical Schools* should be established in polytechnics is commended by the Working Group. (Para 122)

45. *Rural Artisan Training Centres* could be established but the whole programme may be brought within the purview of the NCTVT of the Ministry of Labour & Employment, taking into consideration the actual requirements and the extent to which training programmes of the All India Boards would benefit the rural artisans. (Para 123)

46. The *training of instructors* for Industrial Training Institutes should be organised with a view to seeing that dearth of technical instructors is not felt in the Third Plan as was felt in the second Plan. (Para 124)

47. The training establishments under the Government Departments like the Defence, Railways, etc. be utilised as far as possible to train craftsmen for other industries both on a full time and part-time basis. (Para 126)

Chapter VIII.—Financial provision for development of Technical Education and Vocational Training in the Third Five Year Plan

48. The Committee of the Working Group for degree and Diploma Courses have estimated that a provision of Rs. 201 crores would be required for development programmes etc., in terms of the recommendations of the Working Group, of which Rs. 111 crores would be for continuation schemes and Rs. 90 crores for new schemes. If the programme is phased and a certain spillover of about Rs. 24 crores is allowed to be carried into the Fourth Plan, the provision required would be of the order of Rs. 177 crores. If, however, on account of financial difficulties the amounts could be reduced for hostels, staff

quarters and scholarships and building programmes properly phased, an amount of Rs. 130 crores has been estimated as the minimum provision. (Para 136)

49. The financial provision required for expansion of facilities of D.G.R.E. Centres of Training of craftsmen has been estimated to be of Rs. 84.15 crores. (Para 140)

Chapter IX.—Qualitative Improvement of Institutions

50. Considerable shortages have been noticed in respect of the teaching staff of Diploma and Degree Institutions. It has been estimated that during the third plan period, the additional requirements of teaching personnel for degree and diploma institutions would be of the order of 4,650 and 4,800 respectively. Of these, about 7,055 will be degree holders and 2,401 diploma holders. Steps need to be taken to ensure the requisite supply of teaching staff for technical institutions during the third plan period.

(Paras 143 to 147, also *vide* Para 100)

51. In order to bring about qualitative improvement in technical institutions, efforts need to be made to improve the teacher-pupil ratio with a view to bringing it in conformity with the ratio of 1:10 for degree institutions and 1:15 for diploma institutions as recommended by the All India Council for Technical Education. (Para 148)

52. The procurement of adequate equipment for Technical Institutions has to be facilitated by production of larger quantities of equipment in the country and by use of foreign exchange where necessary. It is also hoped that with the revision of the model list prepared by the All India Council for Technical Education, the difficulties experienced on that account would be removed considerably. (Paras 99 and 161)

53. In order to reduce wastage and stagnation in technical institutions, it is suggested that a liberal scheme of scholarships as recommended earlier may be introduced and other facilities like hostel accommodation etc., may be provided on a larger scale. (Para 166)

APPENDIX I

Members of the Working Group on Technical

1. Prof. M. S. Thacker, Secretary, Ministry of Scientific Research & Cultural Affairs, New Delhi.—*Chairman.*

Ministry of C. & I.

2. Dr. G. P. Kane, Senior Industrial Adviser, Ministry of Commerce & Industry, New Delhi.
3. Dr. B. D. Kalelkar, Senior Industrial Adviser, Ministry of Commerce & Industry, New Delhi.

Ministry of Defence.

4. Dr. D. S. Kothari, Head of the Deptt. of Physics Delhi University, Delhi, and Adviser, Ministry of Defence, New Delhi.
5. Maj. Gen. B. D. Kapur, Chief Controller, Research & Development, Ministry of Defence, New Delhi.

Ministry of Education.

6. Shri P. N. Kirpal, Secretary Ministry of Education, New Delhi.
7. Shri R. K. Kapur, Deputy Educational Adviser, Ministry of Education, New Delhi.

Ministry of Food & Agriculture (Indian Agriculture Research Institute).

8. Dr. E. G. K. Rao, Head of the Department of Agriculture, Indian Agriculture Research Institute, Ministry of Food & Agriculture, (Pusa Road), New Delhi.

Ministry of Home Affairs.

9. Shri R. Prasad, Joint Secretary, Ministry of Home Affairs, New Delhi.

Ministry of Irrigation & Power (C.W. & P.C.)

10. Shri M. Hayath, Chairman, Central Water & Power Commission (Min. of Irrigation & Power), Bikaner House, New Delhi.

Ministry of Labour & Employment D.G.E. & T.

11. Shri S. Abdul Qadir, Director General, Resettlement & Employment, Ministry of Labour & Employment, Talkatora Road Barracks, New Delhi.
12. Shri H. Davenport, Director, Employment Exchanges, DGE & T, Talkatora Road Barracks, New Delhi.

Education & Vocational Training

13. Shri P. Rajnath, Director of Training D.G.E. & T., Talkatora Road Barracks, New Delhi.

Ministry of Railways—Railway Board.

14. Shri R. Krishnaswami, Director (Mech. Engg.), Railway Board, Ministry of Railways, New Delhi.
15. Shri M. A. Qadeer, Director (Establishment), Railway Board, New Delhi.

Ministry of S.R. & C.A.

16. Shri G. K. Chandiramani, Joint Educational Adviser, Ministry of Scientific Research & Cultural Affairs, New Delhi.

17. Shri L. S. Chandrakant, Dy. Educational Adviser, Ministry of Scientific Research & Cultural Affairs, New Delhi.

Ministry of Steel Mines & Fuel.

18. Shri G. Pande, Chairman, Hindustan Steel, Deptt. of Iron & Steel, Ministry of Steel, Mines & Fuel, New Delhi.
19. Shri N. S. Mani, Joint Secretary, Ministry of Steel, Mines & Fuel, New Delhi.
20. Shri A. B. Guha, Coal Mining Adviser, Ministry of Steel, Mines & Fuel, New Delhi.

21. Shri G. Ramanathan, Dy. Secretary, Ministry of Steel, Mines & Fuel, New Delhi.

Ministry of Transport & Communication.

22. Shri P. M. Agarwala, Director-General Post & Telegraphs, Ministry of Transport & Communications, New Delhi.
23. Dr. M. B. Sarwate, Adviser, Wireless Planning & Co-ordination; Ministry of Transport & Communications, New Delhi.
24. *Shri M. V. Pai, Chief Engineer, Overseas Communication Service, Min. of Transport & Communications, 'Radio House', 33, Apollo Bunder, Bombay.

*Shri H. N. Mukerjee was replaced by Shri M. V. Pai as from 9-9-1959.

Ministry of Works, Housing & Supply.

25. @Shri N. Subrahmanyam, Joint Secretary, Ministry of Works, Housing & Supply, New Delhi.
26. Shri N. G. Dewan, Chief Engineer, Central Public Works Deptt. Ministry of Works, Housing & Supply, New Delhi.

University Grants Commission.

27. Dr. B. D. Laroia, Development Officer, University Grants Commission, Old Mill Road, New Delhi.

Experts.

28. Professor S.V.C. Aiyar, Indian Instt. of Science, Bangalore.
29. Shri G. L. Bansal, Secretary-General, Federation of Commerce & Industry, Barakhamba Road, New Delhi.
30. Professor D. L. Deshpande, Director, Bihar Institute of Technology, Sindhri Institute, P.O., Dhanbad (Bihar).
31. Dr. P. K. Kelkar, Director, Indian Institute of Technology, Kanpur.
32. Dr. A. N. Khosla, Vice-Chancellor, University of Roorkee, Roorkee (U.P.). (Has ceased to be member since Dec., 3, '59 on joining Planning Commission).
33. Principal V. Lakshminarayanan, Birla College of Engg., Pilani P.O. (Rajasthan).
34. Shri B. D. Nanda, C/o Damodar Valley Corporation, Anderson Road, Calcutta.
35. Dr. L. K. Rao, President, Indian Instt. of Engineers & Members, Central Water & Power Commission, Bikaner House, New Delhi.

The following members of the staff of the Education Division assisted in the Secretariat Work

- Shri P. Shanker, Miss, Amrit Kaur, Shri D. Mahalplany, Shri D. D. Singh, B. Kaul, Shri C. L. Sapra, A. P. Mehta, K. S. P. Menon.

(b) The following were specially invited to attend the various meetings of the Committees of the Working Group and some attended the two meetings of the Working Group.

1. Shri T. C. Ajmani, Deputy Educational Adviser, Ministry of SR & CA., 7/169, Swaroop Nagar, Kanpur, U. P.
2. Shri R. S. Bhandarkar, Dy. Educational Adviser, Ministry of SR & CA., Western Regional Office, Construction House, Bombay-1.
3. Brig. S. K. Bose, Director, Indian Institute of Technology, Worli, Bombay.
4. Shri N. C. Chakravarti, Asstt. Educational Adviser, Ministry of SR & CA, 5, Esplanade, East, Calcutta.
5. Shri A. R. Dawood, Secondary Education Division, Ministry of Education, Asaf Ali Road, New Delhi.
6. Dr. Douglas Ensminger, Resident Representative of the Ford Foundation in India, 32, Ferozeshah Road, New Delhi.
7. Shri P. N. Gupta, Asstt. Director, Small Scale Industries, New Delhi.
8. Shri S. E. Joseph, Asstt. Chief, Planning Commission, New Delhi.
9. Shri S. P. Madan, Chief Instructor Machine Tool Prototype Factory, Ambarnath.
10. Shri P. M. Mathai, Director, (Industrial Ministry of Community Development & Cooperation, New Delhi).
11. Shri M.V.D. Nair, Asstt. Edn. Adviser, Ministry of SR & CA, New Delhi.

@On retirement, Shri K. S. Krishnaswami was replaced by Shri N. Subrahmanyam as from 19-9-59.

36. Principal A. C. Roy, Bengal Engineering College, Shibpur, Howrah.
37. Principal S. C. Sen, Delhi Polytechnic, Kashmeri Gate, Delhi.
38. Principal B. Sengupta, Director Indian Institute of Technology, Madras.
39. Prof. J. A. Taraporewala, "Panorma" Walkeshwar Road, Bombay-6.
40. Shri T. N. Tolani, Director of Tech-Education, Government of Bombay, Cruckshank Road, Bombay-1.

Planning Commission

41. Shri Tarlok Singh, Addl. Secretary, Planning Commission, New Delhi.
42. Shri M. R. Kothandaraman, Adviser (SS) Planning Commission, New Delhi.
43. Shri Pitamber Pant, Chief (PP), Planning Commission, New Delhi.
44. Shri B. N. Datar, (Chief L & E.) Planning Commission, New Delhi.
45. Dr. K. P. Basu, O.S.D. (SR. Div.) Planning Commission, New Delhi.
46. Shri K. L. Joshi, Director (Education) Planning Commission, New Delhi.—Member Secretary.
- Shri D. P. Nayar, Director (Education) Planning Commission, New Delhi.
- Shri S. N. Saraf, Asstt. Chief, Planning Commission, New Delhi.
- Shri J. L. Azad, Senior Research Office Planning Commission, New Delhi.
- Shri K. R. Sivaramakrishnan, Senior Research Officer, Planning Commission New Delhi.

12. Shri K. L. Nanjappa, Small Scale Industries, Ministry of C. & I., New Delhi.
13. Shri D. V. Narasimham. Dy. Educational Adviser, Ministry of SR & CA, New Delhi.
14. Shri V. R. Reddy, Education Officer, Ministry of SR & CA, Southern Regional Office University Building, Madras.
15. Dr. Ralph W. Ruffner, of the T.C.M.
16. Shri S. R. Sengupta, Director, Indian Institute of Technology, Kharagpur.
17. Shri A. Sarker, Ministry of Community Development & Cooperation, New Delhi.
18. Shri Sham Narain, Asstt. Educational Adviser, Ministry of Education, New Delhi.
19. Shri N. S. Vaidyanathan, Under Secretary, Ministry of C. & I. New Delhi.
20. Mr. F. Wade—Cooper, Genl. Elec. Co. (India) Ltd., New Delhi.



सत्यमेव जयते

WORKING GROUP ON TECHNICAL EDUCATION & VOCATIONAL TRAINING

I. Coordination Committee

1. Professor M. S. Thacker—Chairman
2. Shri Abdul Qadir.
3. Prof. S. V. C. Aiya
4. Shri B. N. Datar.
5. Shri M. Hayath
6. Dr. A. N. Khosla
7. Shri M. R. Kothandaraman.
8. Shri Pitamber Pant.
9. Shri R. Prasad.
10. Shri Tarlok Singh.
11. Shri K. L. Joshi—Member-Secretary.

II. Craftsmen Training and Technical Education at Secondary Education level (including apprenticeship, practical training & part-time courses).

Special invitees

- | | |
|---------------------------------|--|
| 1. Shri S. Abdul Qadir—Convener | 1. Shri A. D. Bohra, Director (PTC), National Small Industries Corporation, Rani Jhansi Road, New Delhi. |
| 2. Shri G. K. Chandiramani | 2. Shri A.S.E. Iyer, Director-General, Small Scale Industries, New Delhi. |
| 3. Shri L. S. Chandrakant | 3. Shri A. Sarkar, CPO (Industries), Ministry of Community Development, New Delhi. |
| 4. Shri A. B. Guha | 4. Shri S. E. Joseph, Asstt. Chief, Planning Commission, New Delhi. |
| 5. Shri K. L. Joshi | 5. Shri A. Prakash, Dy. Secretary, Ministry of Community Development & Cooperation New Delhi. |
| 6. Maj. Gen. B. D. Kapur | 6. Shri D. V. Narasimham, Deputy Educational Adviser, Ministry of SR & CA., New Delhi. |
| 7. Shri R. K. Kapur | 7. Shri K. L. Naniappa, Small Scale Industries, Ministry of C. & I., New Delhi. |
| 8. Shri R. Krishnaswami | 8. Shri N. S. Vaidyanathan, Under Secy., Ministry of C & I, New Delhi. |
| 9. Shri B. D. Nanda (BSS) | 9. Shri P. M. Mathai, Director (Industries) Ministry of Community Development & Corporation, New Delhi. |
| 10. Shri R. Prasad | 10. Shri P. N. Gupta, Asstt. Director, Small Scale Industries, New Delhi. |
| 11. Shri P. Rajnath | 11. Shri Sham Narain, Assistant Educational Adviser, Ministry of Education, New Delhi. |
| 12. Principal S. C. Sen | |
| 13. Prof. J. A. Taraporewala | |
| 14. Shri T. N. Tolani | |
- Shri K. R. Sivaramakrishnan—Secy. Senior Research Officer, Planning Commission.

III. Diploma and Degree Courses (including apprenticeship, practical training and part-time courses).

1. Dr. A. N. Khosla—Convener
2. Prof. S. V. C. Aiya
3. Shri G. K. Chandiramani
4. Shri D. L. Deshpande
5. Shri A. B. Guha
6. Maj. Gen. B. D. Kapur
7. Principal V. Lakshminarayanan
8. Dr. B. D. Laroia
9. Shri M. V. Pai

10. Shri R. Prasad
11. Dr. K. L. Rao
12. Dr. E. G. K. Rao
13. Principal A. C. Roy
14. Principal S. C. Sen
15. Principal B. Sengupto

Shri J. L. Azad—Secretary
Senior Research Officer, Planning
Commission.

IV. Post-graduate study, Research & Training.

1. Dr. D. S. Kothari—Convener
2. Prof. S.V.C. Aiyar
3. Dr. K. P. Basu
4. Shri L. S. Chandrakant
5. Dr. P. K. Kelkar
6. Dr. A. N. Khosla
7. Dr. B. D. Laroia
8. Dr. M. B. Sarwate
9. Shri K. L. Joshi

V. Estimating requirements, wastage etc.

1. Prof. M. S. Thacker—Chairman
2. Shri Tarlok Singh
3. Prof. D. S. Kothari
4. Shri G. K. Chandiramani
5. Shri B. N. Datar
6. Shri H. Davenport
7. Shri K. L. Joshi
8. Shri M. R. Kothandaraman
9. Shri D. P. Nayer
10. Shri Pitamber Pant
11. Shri R. Prasad

Shri S. N. Saraf—Secretary
Asstt. Chief, Planning Commissions.

नमो भगवते वासुदेवाय

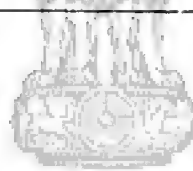
APPENDIX III

Papers, notes, memoranda, considered by the Working Group and its Committees.

Sl.	Author	Subject
1	Aiya, S. V. C.	Technical Education in the III Plan.
2	"	Engineering Education.
3	"	Teachers for Vocational Education
4	"	Comments on Prof. D. L. Deshpande's note regarding the optimum student population.
5	Chandiramani, G. K.	Steps taken for the Training of Teachers for Technical Institutions.
6	"	Part-time/short term courses.
7	Directorate General of Resettlement and Employment (Ministry of Labour & Employment)	Statements indicating sanctions issued upto 31-3-59 for Craftsmen Training Scheme (DGRE) during the Second Five Year Plan—List of Institutes and seating capacity, Trade-wise and State-wise.
8	"	Craftsmen Training Schemes—Programmes for the Third Five Year Plan.
9	"	Training of Overseers, Draughtsmen, etc. under D.G.R.E since discontinued.
10	Deshpande, D. L.	Optimum student population in a Technical Institution (two papers).
11	Guha, A. B.	Location of facilities for the training of craftsmen working in the mines near the industries.
12	"	Assessment of requirements of technical personnel made by Geological Survey of India.
13	"	Requirements of Technical personnel for production of coal during the 3rd Plan period.
14	Joshi, K. L.	Multi-purpose schools with Technical Stream and Jr. Tech. Schools—relationship with Vocational Education.
15	"	Requirements of craftsmen during the Third and Fourth Plans—A tentative exercise.
16	"	Institutional Training for Craftsmen Courses under the existing conditions.
17	"	Comparative study of organisation of Education through correspondence courses in the USSR and the USA.
18	Kapur, B. D.	Expansion of facilities for Technical Education & Training.
19	"	Utilisation of available Tech. Man-power.
20	"	Craftsmen Training in Defence.
21	Kapur, R. K.	Junior Technical Schools and the Technical elective in the Multipurpose Schools.
22	Laroia, B. D.	Need for Part-time Courses.
23	Ministry of SR & CA	Practical Training to Degree & Diploma Holders in Engineering & Technology.
24	Ministry of Labour & Employment	Note on Apprenticeship Training.
25	"	Report of the Advisory Committee on Technical Training 1944-45

Sl.	Author	Subject
26	Ministry of Community Development & Co-operation.	Training programmes for Rural Artisans in the C.D. Areas and requirements of teachers for the training centres for Rural Artisans.
27	Mathai, P. M.	Requirements of Rural Artisans' Training Centres and Instructors thereof in Community Development areas and the facilities required for the training of the Instructors.
28	Ministry of Commerce & Industry (Evaluation Unit)	Facilities provided by All-India Boards for the training of Village Artisans and Craftsmen.
29	Planning Commission (Education Division)	Consideration of development of facilities for Technical Education and Training.
30	" . . .	Assessment of the extent of Development of facilities for Technical Education by the end of the Second Plan.
31	" . . .	Practical Training of Engineering Graduates and Diploma Holders.
32	" . . .	Shortage of teachers for Technical Institutions.
33	" . . .	Problem of utilization of trained manpower.
34	" . . .	Technicums in the U.S.S.R.
35	" . . .	Estimated cost of introducing Merit/Loan Scholarships etc. for the students of Technical Institutions at the Diploma and Degree levels during the Third Five Year Plan.
36	" . . .	Financial outlay for the Development of Technical Education during the Third Five Year Plan—a preliminary exercise.
37	" . . .	Statements regarding enrolment of Physical facilities etc. in respect of some big Technological Institutions in the U.S.A.
38	" . . .	Note on the position of the targets etc. on Industry, Transport, Irrigation and Power Projects in the Third Plan.
39	" . . .	Intake and out-turn of Engineering Graduates and Diploma—holders during 1950-1970.
40	" . . .	Broad Estimates of the requirements of Engineering Personnel 1961-71.
41	" . . .	Augmenting the supply of Basic Science Graduates and improving their quality.
42	" . . .	Wastage in Technical Education (Note)
43	Pant, Pitamber . . .	Preliminary report on wastage in Technical Education.
44	Planning Commission (Village & Small Industries Division)	Present position in regard to the recommendations of the Technical Training Committee (Also known as the Advani Committee).
45	" . . .	Training facilities provided under the Commerce & Industry Ministry's Programme for Small Scale Industry.
46	Prakash, A. . .	Rural Artisans' Training Centres (Institutional and Peri-urban type) for C. D. Areas under the Third Five Year Plan.
47	Rajnath, P. . .	Requirements of Training Facilities provided for teachers of Craftsmen Training Institutes.
48	" . . .	Location of Training facilities in the vicinity of industries.
49	" . . .	Grant of Stipends to the trainees of Industrial Training Institutes/Centres.
50	" . . .	Accommodation for the Central Training Institutes for Instructors.

Sl.	Author	Subject
51	„] . . .	Accommodation for Industrial Training Institutes centres. 1
52	„ . . .	Increasing the period of training in the Central Training Institutes for Instructors.
53	„ . . .	Revision of the Equipment List at present existing for the Industrial Training Institutes and Central Training Institutes for Instructors.
54	„] . . .	Difficulties experienced in recruiting suitable craft instructors and steps taken to overcome these.
55	Rao, E.G.K. . .	Agricultural Engineering Course.
56	Small Scale Industries Board (Ministry of Commerce & Industry).	Minutes of the Twelfth Meeting of the Small Scale Industries Board held at Shillong on 3rd, 4th and 5th Nov. 1958.
57	Small Scale Industries (Ministry of Commerce and Industry).	Training facilities provided by the Small Scale Industries Organisation.
58	Sham Narain . .	Technological Courses in the Rural Institutes.
59	Sarkar, A. . .	Vocational Training Facilities for the unemployed under the Unemployment Insurance Scheme in Japan.
60	Sen Gupta, B.] .	Diploma Education.
61	Tolani, T. N. . .	Technical Teacher Training Programme, Requirements and shortages.
62	Taraporewala, J. A.	A note on Part-time Training.
63	Wellsman, R. P. .	Memorandum on correspondence courses in India.



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APPENDIX IV

GOVERNMENT OF INDIA,

Scientific Policy Resolution No.131 CF 57.

New Delhi, the 4th March, 1958 13th Phalguna, 78.

The key to national prosperity, apart from the spirit of the people, lies, in the modern age, in the effective combination of three factors, technology, raw materials and capital, of which the first is perhaps the most important since the creation and adoption of new scientific techniques can, in fact, make up for a deficiency in national resources, and reduce the demands on capital. But technology can only grow out of the study of science and its applications.

2. The dominating feature of the contemporary world is the intense cultivation of science on a large scale, and its application to meet a country's requirements. It is this, which, for the first time in man's history, has given to the common man in countries advanced in science, a standard of living and social and cultural amenities, which were once confined to a very small privileged minority of the population. Science has led to the growth and diffusion of culture to an extent never possible before. It has not only radically altered man's material environment, but, what is of still deeper significance, it has provided new tools of thought and has extended man's mental horizon. It has thus influenced even the basic values of life, and given to civilization a new vitality and a new dynamism.

3. It is only through the scientific approach and method and the use of scientific knowledge that reasonable material and cultural amenities and services can be provided for every member of the community, and it is out of a recognition of this possibility that the idea of a welfare state has grown. It is characteristic of the present world that the progress towards the practical realisation of a welfare state differs widely from country in direct relation to the extent of industrialisation and resources applied in the pursuit of science.

4. The wealth and prosperity of a nation depend on the effective utilisation of its human and material resources through industrialisation. The use of human material for industrialisation demands its education in science and training in technical skills. Industry opens up possibilities of greater fulfilment for the individual. India's enormous resources of man power can only become an asset, in the modern world when trained and educated.

5. Science and technology can make for deficiencies in raw materials by providing substitutes, or, indeed, by providing skills which can be exported in return for raw materials. In industrialising a country, a heavy price has to be paid in importing science and technology in the form of plant and machinery, highly paid personnel and technical consultants. An early and large development of science and technology in the country could therefore greatly reduce the drain on capital during the early and critical stages of industrialisation.

6. Science has developed at an ever-increasing pace since the beginning of the century so that the gap between the advanced and backward countries has widened more and more. It is only by adopting the most vigorous measures and by putting forward our utmost effort into the development of science that we can bridge the gap. "It is an inherent obligation of a great country like India, with its traditions of scholarship and original thinking and its great cultural heritage, to participate fully in the march of science which is probably mankind's greatest enterprise today."

7. The Government of India have accordingly decided that the aims of their scientific policy will be:—

- (i) to foster, promote, and sustain, by all appropriate means, the cultivation of science, and scientific research in all its aspects—pure, applied and educational;
- (ii) to ensure an adequate supply, within the country, of research scientists of the highest quality, and to recognize their work as an important component of the strength of the nation;
- (iii) to encourage, and initiate, with all possible speed, programme for the training of scientific and technical personnel, on a scale adequate to fulfil the country's needs in science and education, agriculture and industry, and defence;

- (iv) to ensure that the creative talent of men and women is encouraged and finds full scope in scientific activity;
- (v) to encourage individual initiative for the acquisition and dissemination of knowledge, and for the discovery of new knowledge, in an atmosphere of academic freedom;
- (vi) and, in general, to secure for the people of the country all the benefits that can accrue from the acquisition and application of scientific knowledge.

The Government of India have decided to pursue and accomplish these aims by offering good conditions of service to scientists and according them an honoured position, by associating scientists with the formulation of policies, and by taking such other measures as may be deemed necessary from time to time.



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APPENDIX V

PLANNING COMMISSION

(Education Division)

*List of Industrial Training Institutes (D.G.R.E.'s centres for training of craftsmen)
and their likely seating capacity at the end of Second Five Year Plan*

States	Name of the Institutes]	No. of seats
NORTHERN REGION		
1. Punjab	1. I. T. C. Dayanand Polytechnic Institute, Amritsar	384
	2. I. T. C. Mehrchand Technical Institute, Jullundur	288
	3. Industrial Training Institute, Ferozepore	232
	4. Industrial Training Institute, Rohtak	502
	5. Govt. Industrial Training Institute, Patiala	448
	6. Industrial Training Institute, Nabha	144
	7. I. T. C. Polytechnic Instt. Phagwara	128
	8. Industrial Training Instt. Yamunanagar	304
	9. Govt. Moolchand Industrial School, Ambala Cantt.	16
	10. Industrial Training Institute, Sonapat	96
	11. Industrial Training Institute, Gurgaon.	200
	12. Industrial Training Institute, Pathankot	200
	13. I. T. C., Ludhiana	404
	14. Industrial Training Institute, Hissar	200
	TOTAL	3546
(2) Uttar Pradesh	1. I. T. I. Lucknow	672
	2. I. T. I. Allahabad	344
	3. I. T. I. Aligarh	528
	4. I. T. I. Almora	544
	5. I. T. I. Rampur	432
	6. I. T. I. Meerut	312
	7. I. T. I. Dehradun	208
	8. I. T. C. Varanasi	352
	9. I. T. I. Kanpur	1000
	10. Agra	264
	11. Bareilly	264
	12. Gonda	264
	13. Mirzapur	192
	14. Ballia	264
	15. Srinagar	264
	TOTAL	5904
(3) Rajasthan	1. I. T. I. Ajmer	400
	2. I. T. I. Jaipur	224
	3. I. T. I. Kotah	160
	4. I. T. I. Udaipur	160
	5. I. T. I. Jodhpur	152
	6. I. T. I. Bikaner	168
	TOTAL	1264

1	2	3
IV. <i>Jammu & Kashmir</i>	1. I. T. I. Srinagar	164
	2. I. T. I. Jammu	164
	TOTAL	328
V. <i>Delhi</i>	1. I. T. C. Delhi Polytechnic, Delhi	472
	2. I.T.I. Pusa, New Delhi	780
	3. I.T.I. Women, New Delhi	176
	4. I.T.I. Subzimandi, Delhi	224
	TOTAL	1652
VI. <i>Himachal Pradesh</i>	1. I.T.I. Silver-Jubillie Tech. Institute, Mandi	112
	2. I.T.I. Solan	90
	TOTAL	202
EASTERN REGION		
I. <i>Assam</i>	1. I.T.I. Jorhat	416
	2. I.T.I. Srikona	158
	TOTAL	574
II. <i>Bihar</i>	1. Industrial Institute Dighaghat, Patna	736
	2. I.T.I. Ranchi	240
	3. I.T.I. Monghyr	224
	4. Leela Deep Industrial Trg. Institute, Bhagalpur	208
	5. I.T.I. Dehri	256
	6. I.T.I. Darbhanga	192
	7. I.T.I. Dhanbad	288
	8. I.T.I. Katihar	144
	9. I.T.I. Chaibasa	256
	10. I.T.I. Muzaffarpur	288
	11. I.T.I. Gaya	288
	12. I.T.I. Saharsa	192
	13. I.T.I. Hazaribagh	144
	14. I.T.I. Motihari	144
	15. I.T.I. Marhowrah	32
	TOTAL	3632
III. <i>Orissa</i>	1. I.T.C. Cuttack	380
	2. I.T.C. Poor Cottage Industries, Cuttack	48
	3. I.T.I. Hirakud	192
	4. I.T.I. Behampur	200
	5. I.T.I. Rourkela	200
	6. I.T.I. Balasore	66
	TOTAL	1116

1	2	3
IV. <i>West Bengal</i>	1. I. T. C. Tech. School, Calcutta 2. I.T.I. Gariahata 3. I.T.I. Tollygunge 4. I.T.I. How. Home Calcutta 5. I.T.C. Krishnagar 6. I.T.C. Kurseong 7. I.T.I. Kalyani 8. I.T.I. Jhargram 9. I.T.I. Durgapur 10. I.T.I. Chinsurah 11. I.T.I. Cooch-Behar	336 324 416 512 96 112 464 232 616 208 280
	TOTAL	3596
V. <i>Manipur</i>	1. I.T.I. Imphal	96
VI. <i>Tripura</i>	1. I.T.I. Agartala	248
WESTERN REGION		
I. <i>Bombay</i>	1. I.T.I. Bombay 2. I.T.I. Aundh 3. I.T.C. Poona 4. I.T.C. Kolhapur 5. I.T.I. Satara 6. I.T.I. Ramnagiri 7. I.T.I. Dhulia 8. I.T.I. Godhra 9. I.T.I. Jamnagar 10. I.T.I. Kandla 11. I.T.I. Surendranagar 12. I.T.I. Bhavnagar 13. I.T.I. Rajkot 14. I.T.I. Nagpur 15. I.T.I. Akola 16. I.T.I. Amaravati (I)* (Kala Niketan) 17. I.T.I. Amravati (II) 18. I.T.I. Ahmedabad 19. I.T.I. Aurangabad 20. I.T.I. Nanded 21. I.T.I. Surat 22. I.T.I. Karad	764 448 308 144 128 128 88 92 368 168 140 80 64 448 160 104 184 256 250 244 176 240
	TOTAL	4982
II. <i>Madhya Pradesh</i>	1. I.T.I. Indore 2. I.T.I. Rewa 3. I.T.I. Raipur 4. I.T.I. Khandwa 5. I.T.I. Bhopal 6. I.T.I. Jabalpur 7. I.T.I. Gwalior 8. I.T.C. Koni, Bilaspur	396 352 320 320 320 320 264 480
	TOTAL	2772

*To be merged with I.T.I. Amravati after the combined Bldg. is ready.

1	2	3
SOUTHERN REGION		
I. <i>Andhra Pradesh</i>	1. I.T.I. Kakinada	392
	2. I.T.I. Anantapur	384
	3. I.T.I. Vijayawada	312
	4. I.T.I. Nellore	192
	5. I.T.I. Visakhapatnam	288
	6. I.T.I. Hyderabad	324
	7. I.T.I. Warangal	250
	8. I.T.I. Nizamabad	208
	9. Training Centres attached to Govt. Poly- technic, Hyderabad.	184
	TOTAL	2534
II. <i>Kerala</i>	1. I.T.I. Trivandrum	512
	2. I.T.I. Chalakudi	400
	3. I.T.I. Cannanore	400
	4. I.T.I. Dhanuvachapuram	216
	5. Industrial Training Centres, St Vincent Industrials, Kozhikode	224
	6. I.T.I. Kalamasary	96
	TOTAL	1848
III. <i>Madras</i>	1. I.T.I. Cuddalore	252
	2. I.T.I./Nagapatnam	252
	3. I.T.I./Virudhunagar	248
	4. I.T.I./Pettai (Tirunelveli)	252
	5. I.T.I./Guindy Madras-16	400
	6. I.T.C./Street Seva Mandir, Madras	112
	7. I.T.I./North Madras-1	128
	8. I.T.C./Govt. Polytechnic Coimbatore	96
	9. I.T.I. Madurai	128
	10. I.T.C./Pioneer Motor Service, Nagercoil	112
	TOTAL	1980
IV. <i>Mysore</i>	1. I.T.I. Bangalore	480
	2. I.T.I. Gulbarga	258
	3. I.T.I. Mercara	96
	4. I.T.I., Hubli	348
	5. I.T.I. Mangalore	260
	6. I.T.I. Bhadravati	232
	7. I.T.I. Bellary	116
	8. I.T.I. Devangere	120
	9. I.T.I. Mysore	260
	TOTAL	2,170
	GRAND TOTAL	38,444

PLANNING COMMISSION

(Education Division)

Appendix VI-A

List of Engineering/Technological Institutions (Degree Courses) and their likely seating capacity at the end of the Second Five Year Plan.

S.No.	Name of the Institutions	No. of Seats.					Total
		Civil Engg.	Mech. Engg.	Elect Engg.	Tech-nologies*	Others @	
1	2	3	4	5	6	7	8
Northern Region:							
Delhi							
1	Delhi College of Engg. & Tech., Delhi.	N.A.	N.A.	N.A.	N.A.	N.A.	250
							250
Punjab.							
2	Gurumanak Engg. College, Ludhiana	60	30	30	..	..	120
3	Punjab Engg. College, Chandigarh	120	60	60	..	..	240
4	Thapar Instt. of Engg. & Tech. Patiala	60	30	30	..	..	120
5	Technological Instt. of Textile, Bhiwani	..	..	..	60	..	60
6	Deptt. of Pharmacy, Punjab University, Chandigarh	..	..	..	..	15	15
7	Deptt. of Chemical Engg. & Tech., Punjab University, Chandigarh	..	..	..	30	..	30
							585
Rajasthan.							
8	Birla Engg. College, Pilani	60	60	60	..	30	210
9	M.B.M. Engg. College, Jodhpur	90	30	30	..	25	175
10	Birla College, Pilani	..	..	..	..	20	20
							405
Uttar Pradesh.							
11	College, of Engg. & Tech., Muslim University, Aligarh	60	30	30	..	..	120

*Includes courses in Textile Technology, Chemical Engg., Sugar Technology, Petroleum Engg., Fuel Technology etc., @Includes courses in Tele-Communication Mining, Metallurgy, Architecture, Aeronautical Engg., Pharmacy etc.

	2	3	4	5	6	7	8
<i>Orissa</i> ..							
32 College of Engg., Burla .	60	30	30	..	..	..	120
<i>West Bengal.</i>							
33 Bengal Engg. College, Sibpore, Howrah. .	160	60	60	..	120	400	
34 College of Engg. & Tech., Jadavpur	90 20	90 20	90 (20	60 ..	40 ..	370 (60	
			Part time courses)		part time courses).		
35 Deptt. of Applied Physics, Calcutta University, Calcutta . . . .	..	..	..	..	25	25	
36 Institute of Radio Physics and Electronics, Cal- cutta University, Cal- cutta. . . . .	..	..	..	..	20	20	
37 Indian Institute of Tech- nology, Kharagpur . .	100	75	75	15	142	407	
38 College of Textile Tech., Serampur . . . .	..	..	..	30	..	30	
39 Deptt. of Applied Chemistry, Calcutta University, Calcutta . . . .	..	..	..	..	36	36	
40 College of Textile Tech., Brahampur . . . .	..	..	..	30	..	30	
41 College of Leather Tech., Calcutta . . . .	..	..	..	..	10	10	
42 Regional Engg. College, Durgapur	N.A.	N.A.	N.A.	N.A.]	N.A.	280	
						1608	
<i>Western Region.</i>							
<i>Bombay.</i>							
43 Birla Vishwakarma Maha- vidyala, Anand . . .	180	30	30	..	..	240	
44 Engg. College, Poona . .	120	60	60	..	54	294	
45 Faculty of Technology, Baroda University, Ba- roda	120	60	60	50	50	340	
46 Govt. Engg. College, Nag- pur (to be shifted to Aurangabad). . . .	60	30	30	..	..	120	
47 L.D. College of Engg. Ahmedabad	150	90	60	..	..	300	
48 Lukhdhirji College of Engg Morvi	60	20	20	..	..	100	
49 Victoria Jubilee Technical Institute, Bombay . .	70	35	35	25	..	165	
50 Walchand College of Engg. Sangli	80	20	20	..	..	120	
51 Department of Chemical Engg., Bombay Universi- ty, Bombay . . . .	..	..	..	60	115	175	
52 Indian Institute of Tech- nology, Bombay . . .	22	20	24	14	20	100	
53 Laxminarayan Instt. of Tech., Nagpur . . .	..	..	..	36	..	36	

Madhya Pradesh.

Southern Region.

64	College of Engg., Ananta- pur	60	30	30	120
65	College of Engg., Kakinada	60	30	30	120
66	College of Fine Arts, Hy- derabad	25	25
67	College of Engg., Osmania University Hyderabad	90	60	60	..	45	255
68	College of Engg., Andhra University Waltair	60	30	30	120
69	Deptt. of Chemical Tech- nology, Osmania Uni- versity, Hyderabad	30	..	30
70	J.V.D. College of Science & Tech., Waltair	30	15	45
71	Regional Engg., College, Warangal	70	90	90	250
72	College of Engg. Tirupathi	60	30	30	120

Kerala

73	College of Engg., Triven-						
	dram	90	60	60	..	..	210
74	Maharajas' College, Erna-						
	kulam	..	..	..	..	10	10
75	Govt. Engg. College,						
	Trichur	60	30	30	..	..	120
76	T.K.M. Engg. College,						
	Quilon	60	30	30	..	..	120
							460

	1	2	3	4	5	6	7	8
<i>Madras.</i>								
77	A.C. College of Engg. & Tech., Karaikudi . . .		60	30	30	..	..	120
78	College of Engg., Annamalai University, Annamalai nagar . . .		60	30	30	30	..	150
79	College of Engg., Guindy		90	60	60	..	65	275
80	Coimbatore Institute of Tech., Coimbatore. .		60	30	30	..	..	120
81	Govt. College of Engg., Coimbatore . . .		60	30	30	..	..	120
82	Madras Institute of Tech., Chromepet, Madras. .		..	..	..	..	85	85
83	Thiagaraja College, Madurai . . .		60	30	30	..	..	120
84	P.S.C. & Son's Charities College of Technology, Coimbatore . . .		60	30	30	..	..	120
85	Department of Architecture, Madras University, Madras . . .		..	..	..	..	25	25
86	A.C. College of Technology, Madras. . .		..	..	..	42	10	52
87	Dep'tt. of Pharmacy, Medical College, Madras . . .		..	..	..	..	30	30
88	Indian Inst't. of Tech., Madras . . .		N.A.	N.A.	N.A.	N.A.	N.A.	120
								1337
<i>Mysore State.</i>								
89	B.D.T. Engg. College, Devangere . . .		60	30	30	..	..	120
90	B.M.S. College of Engg., Bangalore . . .		60	30	30	..	..	120
91	B.V.B. College of Engg., & Technology, Bhoomiredi. . .		60	30	30	..	..	120
92	Govt. College of Engg., Bangalore . . .		90	60	60	..	..	210
93	National Inst't. of Engg., Mysore . . .		60	30	30	..	..	120
94	Indian Inst't. of Science, Bangalore . . .		..	..	30	30	70	130
95	S.K.S.J. Technological Institute, Bangalore . . .		..	..	..	25	..	25
96	Engg. College, Gulbarga . . .		60	30	30	..	..	120
97	Regional Engg. College, Mangalore . . .		N.A.	N.A.	N.A.	N.A.	N.A.	250
								1215
	Grand Total . . .							13497

PLANNING COMMISSION

(Education Division)

APPENDIX VI-B

List of Engineering/Technological Institutions (Diploma Courses) and their likely seating Capacity at the end of Second Five Year Plan.

S.No.	Name of the Institution	Number of Seats					Total
		Civil Engg.	Mech. Engg.	Elect. Engg.	Tech-nologi-es.	Others@	
1	2	3	4	5	6	7	8
Northern Region.							
Delhi.							
1	Delhi Polytechnic, Delhi	20	20	20	..	..	60
Punjab.							
2	Government Polytechnic, Ambala	120	60	60	..	..	240
3	Guru Nanak Engg. College Ludhiana	60	30	30	..	..	120
4	Mehr Chand Polytechnic, Jullundur	60	30	30	..	..	120
5	National Instt. of Engg., Hoshiarpur	60	30	30	..	..	120
6	Punjab Polytechnic, Nilotkheri	120	60	60	..	..	240
7	Ramgarhia Polytechnic, Phagwara	120	30	30	..	..	180
8	Tarakaran S.D. Tech. Instt. Baijnath	60	..	..	..	..	60
9	Thappar Polytechnic, Patiala	60	30	30	..	..	120
10	Punjab Instt. of Textile Tech., Amritsar	..	..	..	15	..	15
11	Govt. Training Institute, Jullundur	..	..	..	10	..	10
12	Central Polytechnic, Chandigarh	120	60	60	..	..	240
13	Polytechnic, Sirsa	N.A.	N.A.	N.A.	N.A.	N.A.	120
14	Polytechnic, Batala	N.A.	N.A.	N.A.	N.A.	N.A.	120
15	Polytechnic, Rohtak	N.A.	N.A.	N.A.	N.A.	N.A.	120
16	Polytechnic (Location not finalised)	N.A.	N.A.	N.A.	N.A.	N.A.	120
Rajasthan.							2,005
17	Jodhpur Polytechnic, Jodhpur	120	60	60	..	..	240
18	Ajmer Polytechnic, Ajmer	60	..	..	..	..	60
19	Udaipur Polytechnic, Udaipur	60	30	30	..	..	160
20	Polytechnic, Kotah	N.A.	N.A.	N.A.	N.A.	N.A.	120
21	Polytechnic, Alwar	N.A.	N.A.	N.A.	N.A.	N.A.	120
							700

Includes courses in Textile Technology, Leather Technology, Printing Technology, etc.

@ Includes courses in Tele-communication, Mining, Metallurgy, etc.

1	2	3	4	5	6	7	8
<i>Bihar.</i>							
48	Bhagalpur School of Engg. & Tech., Bhagalpur	60	..	..	..	..	60
49	Ranchi School of Engg., Ranchi	120	30	30	..	..	180
50	Dhanbad Polytechnic, Dhanbad	120	60	60	..	..	240
51	Tirhat School of Engg., Muzaffarpur	20	20	20	..	..	60
52	Evening Mining Classes, Bhaga	..	..	..	..	40	40
53	Mining Institute, Jharia	..	..	..	..	40	40
54	Mining Institute, Kodarma	..	..	..	..	40	40
55	Patna School of Engg., Patna	120	30	30	..	..	180
56	Polytechnic, Purnea	N.A.	N.A.	N.A.	N.A.	N.A.	180
57	Polytechnic, Darbhanga	N.A.	N.A.	N.A.	N.A.	N.A.	180
58	Polytechnic, Gaya	N.A.	N.A.	N.A.	N.A.	N.A.	180
							1,380

Orissa

59	Jharsaguda School of Engg., Jharsaguda	120	30	30	..	..	180
60	School of Engg., Cuttak	120	30	30	—	—	180
61	Berhampur School of Engg.	120	30	30	—	—	180
62	Orissa School of Engg., Keonjhar	—	—	—	—	40	40
63	School of Engg., Bhadrak	120	30	30	..	..	180
64	Polytechnic, Kendrapara	N.A.	N.A.	N.A.	N.A.	N.A.	180

Manipur

65	Polytechnic, Imphal, Manipur	30	15	15	..	..	60
							60

Tripura

66	Polytechnic Instt., Narsingarh, Tripura	60	30	30	..	..	120
							120

West Bengal

67	Asansol Polytechnic, Asansol	..	20	20	..	4	80
68	Calcutta Technical School, Calcutta	..	45	45	..	..	90
69	B.P.C. Tech. Instt., Krishnagar	60	30	30	..	..	120
70	Hooghly Instt. of Tech., Hooghly	120	30	30	..	..	180
71	Jadavpur Polytechnic, Jadavpur	120	30	30	..	..	180
72	Jalpaiguri Polytechnic, Jalpaiguri	120	30	30	..	..	180
73	Thargram Polytechnic, Thargram	120	30	30	..	..	180
74	K.G. Engineering Institute, Bishnupur	120	30	30	..	..	180
75	M.B.C. Instt. of Engg. and Tech., Burdwan	120	30	30	..	..	180

1	2	3	4	5	6	7	8
76	Murshidabad Instt. of Tech. Berhampur	120	30	30	..	..	180
77	Purulia Polytechnic, Purulia	120	30	30	..	..	180
78	R.K. Mission Shilpmandir, Belurmath	120	30	30	..	..	180
79	Shri Ramakrishna Vidya-peeth, Suri	60	..	..	..	..	60
80	School of Printing Technology, Calcutta	..	..	..	80	..	80
81	R.K. Mission Shilpa Vidya-peeth, Belghoria	120	30	30	..	..	180
82	Polytechnic, (Ultadanga) Calcutta City	N.A.	N.A.	N.A.	N.A.	N.A.	240
83	Polytechnic, (Barasat) 24 Parganas	N.A.	N.A.	N.A.	N.A.	N.A.	120
84	Polytechnic, Malda	N.A.	N.A.	N.A.	N.A.	N.A.	120
							2,710

Western Region

Bombay

85	Bhailalbai Bhikabhai Polytechnic, Anand	90	30	30	..	..	150
86	Government Polytechnic, Poona	180	60	60	..	20	320
87	Dr. S. & S.S. Gandhi College of Engg. & Tech., Surat	60	30	30	..	20	140
88	Polytechnic, M.S. University, Baroda	180	60	60	..	..	300
89	Faculty of Engg. & Tech., M.S. University, Baroda	..	..	..	30	30	60
90	Government Polytechnic, Aurangabad	60	30	30	..	..	120
91	Government Polytechnic, Karud	60	30	30	..	..	120
92	Government Polytechnic, Aravati	60	30	30	..	..	120
93	Government Polytechnic, Nagpur	90	30	30	..	60	210
94	Government Polytechnic, Sholapur	60	30	30	..	..	120
95	Instt. of Engg. & Tech., Dhulia	60	..	..	..	..	60
96	Government Polytechnic, Ahmedabad	180	60	60	..	..	300
97	Lukhdhirji College of Engineering, Morvi	60	20	20	..	..	100
98	* Sir A. V. Parckh Tech. Instt., Rajkot	..	..	..	..	10	10
99	Shri Bhavsinghji Polytechnic, Bhavnagar	60	30	30	..	30	150
100	Sir Cusrow Wadia Instt. of Electrical Technology, Poona	60	30	30	..	20	140
101	Government Tanning Institute, Khar, Bombay	..	..	..	15	..	15
102	Puranmal Lahoti Sararak Technical Instt., Latur	60	..	..	..	..	60
103	St. Xavier's Tech. Instt., Bombay	..	..	..	..	81	81

1	2	3	3	4	5	6	7
104	Victoria Jubilee Tech. Instt., Bombay	60	40	40	40	40	220
105	Walchand College of Engg., Sangli	60	30	30	..	..	120
106	R.C. Technical Instt., Ahmedabad	..	..	..	45	..	45
107	Regional School of Printing Tech., Bombay	..	..	..	25	..	25
108	Government Polytechnic, Dohad	60	30	30	..	..	120
109	Polytechnic, Bombay	N.A.	N.A.	N.A.	N.A.	N.A.	300
110	Polytechnic, Jalgaon	N.A.	N.A.	N.A.	N.A.	N.A.	120
111	Polytechnic, Porbandar	N.A.	N.A.	N.A.	N.A.	N.A.	120
112	Polytechnic, Mehsana	N.A.	N.A.	N.A.	N.A.	N.A.	120

3,766

Madhya Pradesh

113	Central Technical Instt., Gwalior	60	30	30	..	..	120
114	Government Polytechnic, Ujjain	60	30	30	..	12	132
115	Government Polytechnic, Jabalpur	60	30	30	..	..	120
116	Government Polytechnic, Nowgong	60	30	30	..	..	120
117	Govindram Todi Govt. Polytechnic, Jaora	60	15	15	..	..	90
118	Samrat Ashok Poly., Bhilsa	60	..	..	..	..	60
119	Kirodimal Govt. Polytechnic, Raigarh	60	30	30	..	..	120
120	S.V. Patel Polytechnic, Bhopal	90	60	60	..	..	310
121	Sri Govindram Seksaria Technological Instt., Indore	90	30	30	..	..	150
122	Leather Technical Institute, Morar	..	..	..	30	..	30
123	Mining Institute, Chhindwara	..	..	..	..	40	40
124	Polytechnic, Khundwa	N.A.	N.A.	N.A.	N.A.	N.A.	120
125	Polytechnic, Drug	N.A.	N.A.	N.A.	N.A.	N.A.	120

1,432

*Southern Region**Andhra Pradesh*

126	Andhra Polytechnic, Kakinada	60	60	60	..	60	240
127	Attached Polytechnic to the College of Engg. Anantapur	60	30	30	..	..	120
128	Government Polytechnic, Vizagapatnam	60	60	60	..	..	180
129	Government Technical College, Hyderabad	90	60	60	..	60	270
130	Government Polytechnic, Warangal	60	30	30	..	..	120
131	Government Polytechnic, Tirupathi	90	45	45	..	..	180

1	2	3	4	5	6	7	8
132	Hyderabad Polytechnic, Hyderabad	60	30	30	..	..	120
133	Vuyyuru Polytechnic, Vuyyuru	90	45	45	..	..	180
134	Mining Institute, Kotha- gudium	..	..	..	..	40	40
135	Mining Institute, Gudur	..	..	..	..	40	40
136	Ceramic Institute, Gudur	..	..	..	..	23	23
137	Government Polytechnic, Proddattur	60	30	30	..	..	120
138	Government Polytechnic, Nizamabad	60	30	30	..	..	120
139	Krishna Devarya Poly- technic, Wanaparthi	60	30	30	..	..	120
140	M. V. M. Polytechnic, Tenuku	60	30	30	..	..	120
141	Mahboobnagar Polytechnic, Mahboobnagar	60	30	30	..	..	120
							2,113

Kerala

142	Algappanagar Polytechnic, Algappanagar	60	30	30	..	..	120
143	Government Polytechnic, Kalmassary	60	60	30	..	20	170
144	Kerala Polytechnic, Kozhi- koda	100	50	50	..	20	220
145	Maharajas' Tech. Institute, Trichur	60	30	30	..	..	120
146	Shri Narayana Polytechnic, Quilon	60	30	30	..	..	120
147	Government Polytechnic Cannanore	60	30	30	24	..	144
148	Central Polytechnic, Tri- vandrum	60	30	30	..	..	120
149	Carmel Polytechnic, Alle- pey	60	30	30	..	..	120
150	N.S.S. Polytechnic, Pand- lam	60	30	30	..	..	120
151	Shri Rama Polytechnic, Valappad	60	30	30	..	..	120
152	Polytechnic, Kottayam	NA	N.A.	NA	NA	NA	120

1,494

Madras

153	Alagappa Polytechnic, Karikudi	60	30	30	..	..	120
154	A.M.M. Charities Trust Poly., Avadi	60	30	30	..	..	120
155	Annamalai Polytechnic, Chettinad	60	30	30	..	..	120
156	Central Polytechnic, Madras	90	60	60	..	..	210
157	C.N.T. Institute, Veppery, Madras	60	30	30	..	..	120
158	Government Polytechnic, Coimbatore	60	60	30	..	80	230

	1	2	3	4	5	6	7	8
159	Institute of Leather Tech., Madras	..	..	..	..	30	30	
160	Ramakrishna Mission Tech. Instt., Madras	..	..	..	..	30	30	
161	Nachhimathu Polytechnic, Pollachi	60	30	30	..	..	120	
162	P.S.G. & Attached Poly- technic, Coimbatore	60	30	30	..	..	120	
163	P.S.G. Industrial Institute, Coimbatore	..	..	..	60	..	60	
164	Shesashayee Institute of Technology, Ciruchira- palla	60	30	30	..	..	120	
165	Tamilnad Polytechnic, Madurai	60	80	40	..	20	200	
166	Government Polytechnic, Nagercoil	60	..	60	..	..	120	
167	Government Polytechnic, Vellore	60	..	60	..	..	120	
168	Regional School of Printing Tech., Madras	..	..	..	180	..	180	
169	Desigar Polytechnic, Tan- jore	60	30	30	..	..	120	
170	Sankar Polytechnic, Sankarnagar	60	30	30	..	..	120	
171	Thiagaraja Polytechnic, Salem	60	30	30	30	..	150	
172	Muthiah Polytechnic, Annamalainagar	60	30	30	..	..	120	
173	S.V. Nodar Polytechnic, Vurdunagar	60	30	30	..	..	120	
							2,650	

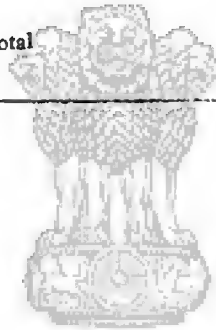
Mysore

174	S.K.S.J. Tech. Instt. Bangalore	..	..	..	40	..	40	
175	Silver Jubilee Occupational Instt., Bangalore	60	60	60	..	105	285	
176	School of Mines, Oorgaum	..	..	..	..	40	40	
177	B.V.B. College of Engg., & Tech., Hubli	60	30	30	..	..	120	
178	D.R.R. Occupational Instt., Davangere	50	30	50	..	..	130	
179	Govt. Polytechnic, Gul- barga	60	30	30	..	..	120	
180	Karnataka Polytechnic, Mangalore	60	30	30	..	..	120	
181	K.H. Kabbar Instt. of Engg., Bharwar	60	30	30	..	..	120	
182	National Institute of Engineering, Mysore	60	..	30	..	..	90	
183	Occupational Instt., Chin- tamani	60	30	30	..	..	120	
184	Govt. Polytechnic, Bellary	60	30	30	..	..	120	
185	Polytechnic, Tunkur	60	30	30	..	..	120	
186	Polytechnic, Chennapat- nam	60	30	30	..	..	120	
187	Silver Jubilee Tech. Instt., Bhadravati	..	30	..	..	..	30	
188	S.L.V. Occupational Instt., Hasan	60	30	30	..	..	120	

1	2	3	4	5	6	7	8
189	M.E. Society's Polytechnic, Bangalore	60	30	30	..	..	120
190	Acharya Patsala Polytechnic Bangalore	60	30	30	..	..	120
191	B.V. & V.S. Polytechnic, Bagalkot	60	30	30	..	..	120
192	Government Polytechnic, Karwar	..	..	..	..	..	120
193	Government Polytechnic, Belgaum	60	30	30	..	..	120
194	Government Polytechnic, Chickmagalur	60	30	30	..	..	120
195	Polytechnic, Mandya	NA	NA	NA	NA	NA	120
196	Polytechnic, Raichur	NA	NA	NA	NA	NA	120
							<u>2,675</u>

Pondicherry.

197	Polytechnic, Pondicherry	NA	NA	NA	NA	NA	120
							<u>120</u>
Grand Total							<u>25,597</u>



सत्यमेव जयते

APPENDIX VII

No. 4/1(6)/59-Edn.

GOVERNMENT OF INDIA

PLANNING COMMISSION

UDYOG BHAVAN

New Delhi-2, dated the 17th June, 1959.

OFFICE MEMORANDUM

SUBJECT :—*Manpower requirements relating to the Third Five Year Plan.*

The Working Group on Technical Education has constituted a sub-committee with a view to discussing with Central Ministries their estimates of manpower requirements for the Third Five Year Plan. Shri R. Prasad, Joint Secretary and Director of Manpower, Ministry of Home Affairs, will serve as the convener of the sub-committee which will also include officers from the Planning Commission and the Ministry of Scientific Research and Cultural Affairs. Shri Prasad has been requested to get into touch with different Ministries.

2. The Sub-Committee has drawn up a short check list (enclosed) on reverse setting out points on which Ministries will kindly send information at present available with them. This information may be sent to the Education Division, Planning Commission, with copies to (1) Directorate of Manpower, Ministry of Home Affairs, (2) Ministry of Scientific Research and Cultural Affairs and (3) Perspective Planning and Scientific and Technical Manpower Division of the Planning Commission. It is requested that the information may be sent by the end of June. It is appreciated that at this stage a considerable part of the information will be of a tentative nature and related to specific assumptions. It is hoped, however, that the officers concerned with manpower planning in different Ministries will endeavour to bring together the necessary information and will also indicate points on which they would like to have the provisional suggestions of the Secretariat of the Planning Commission.

Sd.:-

(TARLOK SINGH)

Additional Secretary to the
Government of India.To
All Central Ministries

(APPENDIX VII-2)

Check list for information regarding Manpower Requirements requested from Central Ministries.

(1) Categories of engineering personnel of various levels such as Post-graduates, Graduates, Diploma holders and Craftsmen, along with basic educational and professional qualifications required.

(2) Number of persons likely to be in position in 1960-61.

(3) Provisional targets of capacity/production proposed for the Third Plan in different fields of development assumed for making estimates of manpower requirements. For major projects break-up may be furnished separately.

(4) Preliminary estimates of investment/outlay required for implementing the targets set out in (3) above.

(5) Additional engineering personnel i.e. Post-graduates, Graduates, Diploma holders and Craftsmen in different fields required to implement the targets in (3) above. The personnel required to replace those in position after 1960-61 as a result of death, retirement etc. may be indicated separately.

(6) Total engineering personnel expected to be in position in 1965-66.

(7) If available, tentative targets of capacity/production and investment proposed for the fourth plan and the personnel requirements including those for replacement.

(8) A short note indicating the assumptions made in making estimates, the action taken or proposed to be taken by the Ministry to train personnel through in-service and practical training etc. and suggestions which they would like to make for augmenting the existing technical education facilities is requested.

APPENDIX VIII

Assumed Targets of output/capacity in the third plan

Serial No.	Ministry	Main Targets indicated (1961-66)
1	2	3
1.	Ministry of Education	265 to 465 multi-purpose schools with technical courses.
2.	Ministry of Labour and Employment	(i) Craftsmen Training Schemes 10,000 additional seats ; (ii) National Apprenticeship Training Scheme 14,000 seats ; (iii) Evening classes for Industrial Workers 12,000 seats ; and (iv) Craft Instructor Training Scheme 2,260 seats.
3.	Ministry of Commerce and Industry	(a) <i>Heavy Electricals, Bhopal.</i> Value of the output per annum: Rs. 25 crores. (b) <i>Public Sector</i> (i) Expansion and development of Heavy Machine Tools ; Foundry and Mining machinery. (ii) Establishment of Heavy Machines Tools, Heavy plate and vessels and structural plant. (c) <i>Private Sector.</i> The outlay assumed is Rs. 1300 crores during the third plan. (d) <i>Small scale Industries</i> The outlay assumed is Rs. 212 crores during the third plan.
4.	Ministry of Railways	(i) Increase in freight traffic 92 million tons (ii) Increase in passenger traffic 20% above the second plan. (iii) Increase in other coaching traffic 15% for non-passenger carrying stock. (iv) New Lines : about 2,000 miles. (v) Electrification : about 1,200 route miles. (vi) Rolling stock ; Locomotives 1936 ; coaching stock 8904, wagons 143882 (includes both replacements and additions).
5.	Atomic Energy	250 M.W. nuclear power.
6.	Ministry of Community Development and Cooperation.	Additional 1600 Blocks.
7.	Ministry of Food and Agriculture.	(a) A continuing annual expansion of agricultural production at the rate of about 5% in the third plan.
	(a) Deptt. of Agri.	
	(b) Deptt. of Food	(b) (i) Add. Sugar Factories : 35 (ii) Installed capacity (sugar) : 3.3 million tons. (iii) Target of production (sugar) : 3.0 million tons.

Serial No.	Ministry	Main Targets indicated (1961-66)
1	2	3
8.	Ministry of Steel, Mines and Fuel	<p>(a) <i>Deptt. of Coal</i></p> <p>(i) Drills 150.</p> <p>(ii) Targets of Coal Production by the end of the Third Plan : 100 to 120 million tons.</p> <p>(b) <i>Geological Survey of India.</i> The provisional target for Geological mapping during the third plan has been fixed at 155185 Sq. miles. Drilling will also be conducted for base metals and other minerals and metalliferous deposits.</p> <p>(c) <i>Deptt. of Iron and Steel</i> Additional Production capacity of Steel ingots : 4 million tons.</p>
9.	Ministry of Health	1/2 to 2 crores of people to be provided with safe water supplies and satisfactory arrangements for excreta and Water disposal.
10.	Ministry of Information and Broadcasting.	Schemes of the All India Radio cannot be defined in terms of any unit. However, a provision of 18.5 crores has been proposed against the likely outlay of Rs. 7½ crores during third plan.
11.	Ministry of Works Housing and Supply.	Construction of Houses : 9,83,000.
12.	C.S.I.R.	Expansion and Development of National Laboratories/Research Institutes.
13.	Ministry of Rehabilitation	Dandakaranya Project.
14.	Ministry of Defence	N. A.
15.	Ministry of Scientific Research and Cultural Affairs.	Construction and development of existing facilities and provision of additional capacity in Degree and Diploma Institutions by 6,000 and 15,000 respectively.
16.	Ministry of Irrigation & Power.	<p>(i) Present aggregate installed generating capacity would grow to about 12.8 million K. W.</p> <p>(ii) Development of hydro-power would continue to predominate over thermal power development.</p> <p>(iii) Important development will take place in transmission grid net work.</p>
17.	Ministry of Transport and Communication.	1. Establishment of 18 additional Radio-sonde/Radar Stations (This includes the production and supply of Radio-sonde instruments and accessories at the rate of about 30,000 per year by the end of the Plan.
	(a) India Meteorological Department.	

Serial No.	Ministry	Main Targets indicated (1961-66)
1	2	3
		<ol style="list-style-type: none"> 2. 8 additional Weather Radar Stations. 3. 3 additional sfarics stations. 4. Transmission of Weather hars by Facsimile and their reception at 10 stations. 5. 6 atmospheric electricity stations. 6. Development of a prototype radio- wing finding equipment and the construction of about 10 sets for the gradual establishment of 18 new stations using this and similar equipment. 7. Construction of radiatios instruments for an additional net work of stations at the rate of about 4 per year. 8. Development of a prototype sfaricat equipment and the construction of about 10 such sets. 9. Modernisation of the departmental workshop and the introduction of quality control in production. 10. Construction of a primary standard Barometer for India. 11. Design and development of : <ol style="list-style-type: none"> (i) Automatic weather station (ii) Ceilometers. (iii) 5 om. Weather Radar. (iv) Ozone Sonde. (v) Closed Top and base indicator. (vi) Development of Geophysical activities. (vii) Organisation of training section for providing training facilities for new recruits in the field of specialised ments to be used by the department.
	(b) Overseas Communications Services	<ol style="list-style-type: none"> 1. 54 major equipment viz., 16 Transmitters, 18 Receivers and 20 'multiplex equipment would be installed. 2. 12 additional telegraph circuits and 8 Radio-photo Services would be established during the Plan period.
	(c) India Telephone Industries	<ol style="list-style-type: none"> 1. Telephones—2,00,000 Nos. 2. Exchange lines—1,00,000 Nos. 3. Transmission equipment—2000 channels
	(d) Indian Airlines Corporation	<ol style="list-style-type: none"> 1. 30 Dakota aircraft are expected to be replaced by twin Dart engine type of aircraft. 2. Replacement of the present fleet of 5 sky masters by Viscount type aircraft. 3. Purchase of workshops plant, machinery, tools, etc.
	(e) Air-India International.	<ol style="list-style-type: none"> 1. 5 additional Jet aircraft. 2. Construction of additional permanent hanger annexe for workshops. 3. Jet engine overhaul facilities including building. 4. Purchase of workshop equipment to cater for additions and replacements for existing equipment.

1	2	3
(f) Posts & Telegraphs Department		1. Auto exchange system 7,12,000. 2. Manual exchange system 70,000. 3. Carrier equipment 12 channels and 30 channels and single channels—1,396 systems. 4. Co-axial and underground trunk cables 14,000 miles. 5. Trunk Exchange, Tele, etc : 799 bds. 6. Telegraph Officers—1500.
(g) Wireless Planning and Coordination Organisation.		N.A.
(h) Roads Wing		1. National Highways—1,820 miles. 2. State Highway—3,500 miles. 3. Major District Roads—5,480 Miles. 4. Other District Roads—10,170 miles. 5. Classified village Roads—6,830 miles.
(i) Bombay Port-Trust	}	To improve the existing port facilities.
(j) Port of Cochin		
(k) Kandla Port		
(l) Vizagapatnam Port		To handle about 2 million tons of ore and General Cargo in traffic.
(m) Hindustan, Shipyard, Visakhapatnam		To increase the production capacity from 6 to 8 ships per year.
(n) Port of Calcutta		To increase the existing port facilities.
(o) Works at Aerodromes		N.A.
(p) Aeronautical Comm. Service		N.A.
(q) Training & Education Organisation		(i) 10 additional Gliding Centres. (ii) 15 new Flying Clubs.
(r) Air Routes and Aerodromes organisation.		(i) Procurement of aerodrome equipment. (ii) Maintenance and operation of Aerodrome equipment.
(s) Research and Development organisation		Undertaking of various research projects.
(t) Aeronautical Inspection Organisation		N.A.
(u) Passenger and Goods Vehicles in India.		(i) Passenger Vehicles : 35,000. (ii) Goods Vehicles. : 12,000.
Ministry of Home Affairs		N.A.

PLANNING COMMISSION

(Education Division)

APPENDIX IX

Additional Requirements of Engineering Personnel during the Third Plan as indicated by the Ministries—Graduates

Head	Outlay for the third plan proposed by Working Groups/Ministries (Rs. in crores)	Civil	Mechanical	Electrical	Tele-Comm.	Chemical	Metallurgy	Mining	Others*	Total	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
I. Agriculture and Community Development											
(a) Food & Agri. Community Development	1,621	200	150	150	..	..	..	..	1,102	1,602†	†Includes requirements under minor irrigation also.
(b) Community Development	..	..	..	..	..	..	..	..	..	..
TOTAL	1,621	200	150	150	..	..	..	..	1,102	1	

I	2	3	4	5	6	7	8	9	10	11	12
II. Irrigation and Power . .	2,084	3,227	871	13,127	..	..	..	..	..	7,225	
III. Village and Small Scale Industries	330	14	86	54	..	28	..	..	18	200	
IV. Industries and Mining											
(a) Com. & Industry**	420	420	1,970	500	..	400	380	..	..	3,670	
(b) Steel, Mines and Fuel											
	2,068	15	2,305	220	..	60	..	3,000	132	5,732	
		24	563	170	..	52	22	..	469	1,300	
(c) Geological Survey of India		..	69	133	..	..	..	..	463	665	
(d) Iron & Steel		400	674	508	..	272	597	80	35	2,566	
TOTAL .	12,068	859	5,581	15,331	..	784	999	3,080	1,099	13,933	
V. Transport and Communications											
(a) Deptt. of Transport		2,637	43	217	..	..	..	..	44	2,941	
(b) Deptt. of Communications	3,072	384	23	321	3,332	1	3	..	303	4,367	
(c) Railways .		520	91	102	83	..	..	..	..	796	
TOTAL .	3,072	3,541	157	640	3,415	1	3	..	347	8,104	

APPENDIX IX-2

I	2	3	4	5	6	7	8	9	10	11	12
VI. Social Services											
(a) Education†		200	150	150	..	..	..	..	..	500	
(b) SR & CA ‡		1,260	1,801	2,708	285	350	120	181	350	7,055	
(c) C. S. I. R.		45	60	60	2	50	40	15	70	342	
(d) Home Affairs		43	12	13	10	1	..	..	1	80	
(e) Information and Broadcasting	2,565	3	..	..	307	..	..	..	2	312	
(f) Works, Housing and Supply		550	80	90	..	90	..	..	87	897	
(g) Rehabilitation		40	..	..	..	..	..	..	..	40	
(h) Health		400	..	..	..	..	..	..	..	400	
(i) Labour and Employment		..	468	27	..	..	..	21	..	516	
(j) Atomic Energy		116	3	3	..	..	..	29	303	454	
TOTAL	2,565	2,657	2,574	3,051	604	491	160	246	813	10,596	
VII. Construction Programmes											
		2000	..	1000	..	..	..	..	276	3,276	
Total (Public Sector)†	11740 (plus 400 of Inventories)..	12498	9419	[9553]	4019	[1304]	1162	3326	3655	44,936	

	I	2	3	4	5	6	7	8	9	10	11	12
VIII. Others			434	513	493	460	..	60	..	..	..	1,960
IX. Private Sector												
(i) Industry ***		1300	889	6691	3500	..	2217	74	..	782	14,153	
(ii) Housing @		1200	2000	..	500	..	..	..	..	230	2,730	
(iii) Others (Agriculture, Irrigation, Electricity)		1500	2250	500	2000	..	100	..	..	150	5,000	
Total (Private Sector)		4000	5139	7191	6000	..	2317	74	..	1162	21,883	
Grand Total (Public, Defence and Private)		16140	18071	17123	16046	4479	3621	1296	3326	4817	68,779	
Percentage to total			26.3	24.9	23.3	6.5	5.3	1.9	4.8	7.0	100.0	

*Includes categories of personnel like Sugar, Jute, Leather Technologists and Automobile Aeronautical, Marine and Naval Architecture, Public Health and Sanitary, Architectural and Town Planning, Agricultural Geology/Geophysics/Applied Geology Engineers.

**The Ministry of Commerce and Industry have sent information in regard to the projects : Heavy Machine Building, Foundry Forge Projects at Ranchi, Coal Mining Machinery at Durapur and Heavy Electricals Corporation, Bhopal. The engineering personnel requirements of Heavy Machine Tools, Heavy Plate and Vessels and Heavy Structural, Hindustan Machine Tools, Fertiliser Plants at Sindri, Nangal have not been sent. In regard to these some rough estimates have been made.

†The Ministry of Education have lumped the requirements and the category-wise break-up has been estimated.

‡The requirements have been estimated in the Planning Commission and generally agreed to by the Ministry of SR & CA. During the Second Plan the estimated expenditure on buildings and constructions is about Rs. 1,000—12,00 crores (vide para 50 page 22 of Appraisal and Prospects of the Second Five Year Plan) and assuming that there would be comparatively less emphasis on buildings and construction during the Third Plan, the rough estimates of expenditure would be about Rs. 1500 crores or so.

The estimates of requirements of engineering personnel have been worked out on this assumption.
91 The Housing Division of the Planning Commission have estimated that the expenditure on Housing Programmes in the private sector during the Second Plan is likely to be of the order of Rs. 800 crores. During the Third Plan an expenditure of Rs. 1200 crores has been assumed and requirements of Engineering personnel estimated on this basis.

***The information has been made available by the Development Wing of the Ministry of Commerce & Industry.

APPENDIX X
PLANNING COMMISSION
(EDUCATION DIVISION)

Additional Requirements of Engineering Personnel during the Third Plan as indicated by the Ministries—Diploma-holders

Heads	Outlay for third plan proposed by Working Groups/Ministries (Rs. in crores)	Civil	Mechanical	Electrical	Tele-Comm.	Chemical	Metallurgy	Mining	† others	Total	Remarks.
I	2	3	4	5	6	7	8	9	10	11	12
I. Agriculture and Community Development:											
(a) Food & Agriculture	1621	600	129	..	..	..	..	..	..	729	* In cludes re-quirements under minor irrigation also.
(b) Community Devpt.	..	1600	..	..	..	..	..	..	..	1600	
TOTAL	1621	2200	129	..	..	..	..	..	..	2329	
II. Irrigation & Power											
	2084	8512	1140	5166	..	..	..	..	..	14818	
III. Village & Small Scale Industries †											
	330	310	1290	810	..	420	..	..	170	3000	

IV. Industries & Mining:

(a) Comm. & Industry *	630	2900	1080	..	600	570	..	..	5780
(b) Stee, Minis & Fuel									
(i) Coal	45	1805	1760	..	300	..	7950	..	11860
(ii) Oil	35	816	702	..	102	..	..	34	1689
(iii) Geological Survey of India	110	204	20	..	..	..	..	..	334
(iv) Iron & Steel	2068	100	864	580	220	496	..	..	2260
TOTAL	2058	920	6589	4142	1222	1066	7950	34	21923

V. Transport & Communications:

(a) Deptt. of Transport	14922	48	40	..	..	..	..	..	15010
(b) Deptt. of Comm. & Civil Aviation	298	198	177	82	..	..	..	27	782
(c) Railways	3072	1348	148	339	385	..	..	..	2220
TOTAL	3072	16568	394	556	467	..	..	27	18012

VI. Social Services:

(a) Education*	247	148	165	..	..	..	..	..	560
(b) S.R. & C.A. @	931	656	614	20	20	15	25	120	2401
(c) C.S.I.R.	55	103	55	..	1	12	..	30	256
(d) Home Affairs	69	16	35	..	..	..	..	..	120

I		2	3	4	5	6	7	8	9	10	11	12
(e) Information & Broadcasting		2565	..	..	..	..	..	..	..	2	2	
(f) Works, Housing & Supply		3006	100	258	..	..	..	..	..	414	3778	
(g) Rehabilitation		150	..	..	..	..	..	..	..	..	150	
(h) Health		1000	..	..	..	..	..	..	..	..	1000	
(i) Labour & Employment		20	2307	127	..	..	..	..	12	2	2468	
(j) Atomic Energy		125	43	11	..	..	..	..	15	1	195	
TOTAL		2565	5603	3373	1265	20	21	27	52	569	10930	
VII. Construction Programmes			13760	..	960	..	..	..	..	1680	16400	
TOTAL (Public Sector)		11740 (plus 400 of inventories)	47873	12915	12899	487	1663	1093	8002	2480	87412	
VIII. Others			490	1142	386	278	..	36	..	..	2332	
IX. Private Sector:												
(i) Industry ††		1300	1680	13717	6970	..	2254	143	..	1268	26032	
(ii) Housing §§		1200	11808	..	824	..	..	..	..	1442	14074	
(iii) Others (Agriculture, Irrigation, Electricity etc.)		1500	4125	750	2250	..	150	..	..	225	7500	
TOTAL (Private Sector)		4000	17613	14467	10044	..	2404	143	..	2935	47606	

GRAND TOTAL (Public, Defence & Private)	16140	65976	28524	23329	765	4067	1272	8002	5415	137350
Percentage to the Total		48.0	20.8	17.0	0.6	3.0	0.9	5.8	3.9	100.0

† Includes categories of personnel like Sugar, Jute, Leather, Technologists and Automobile, Aeronautics, Marine and Naval Architecture, Public Health & Sanitary, Architectural and Town Planning Engineers.

* The Ministry of Commerce & Industry have sent information in regard to the projects ; Heavy Machine Building, Foundry Forge Projects at Ranchi, Coal Mining Machinery at Durgapur and Heavy Electricals Corporation, Bhopal. The Engineering Personnel requirements of Heavy Machine Tools, Heavy Machine Tools, Heavy Vessels and Heavy Structural, Hindustan Machine Tools, Fertiliser Plants at Sindhri, Nangal have not been sent. In regard to these some rough estimates have been made.

+* The Ministry of Education have lumped the requirements and the category-wise break up has been estimated.

@ The requirements have been estimated in Planning Commission and generally agreed to by the Ministry of S.R. & C.A.

§ During the Second Plan the estimated expenditure on buildings and constructions is about Rs. 1000—1200 crores (*vide* para 50, page 22 of Appraisal and Prospects of the Second Five Year Plan) and assuming that there would be comparatively less emphasis on buildings and constructions during the Third Plan, the rough estimates of expenditure would be about Rs. 1500 crores or so. The estimates of requirements of engineering personnel have been worked out on this assumption.

§§ The Housing Division of the Planning Commission have estimated that the expenditure on Housing programmes in the Private Sector during the Second Plan is likely to be of the order of Rs. 800 crores. During the third plan an expenditure of Rs. 1200 crores has been assumed and requirements of engineering personnel estimated on this basis.

†† The information has been made available by the Development Wing of the Ministry of Commerce & Industry.

PLANNING COMMISSION
(EDUCATION DIVISION)

Additional Requirements of Craftsmen during the Third Plan as indicated by the Ministries

Engineering Trades

Head	1	2	3	4	5	6	7	8	9	10	11	12	13
		Black-smiths	Carpenters	Draughtsmen (Civil)	Draughtsmen (Mech)	Electricians	Electro Platers	Fitters	Grinders	Linesmen & Wiremen	Machinists	Mechanic Instrument	Mechanic I.C. Engine
I. Agricultural and Community development													
(a) Food and Agriculture	
(b) Community Development	
TOTAL	
II. Irrigation and Power	
III. Small Scale Industries	
IV. Industries and Mining	
(a) Heavy Electricals, Bhopal		747

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	14	15	16	17	18	19	20	21	22	23	24	25	26	27
	Mec- hanic Radio Motor.	Mec- hanic Motor.	Mou- lders	Pain- ters & Dec- orators.	Pat- tern mak- ers.	Plum- bers.	Sheet Metal work- ers.	Sur- vey- ors.	Tool mak- ers.	Tur- ners.	Watch & clock repa- irers	Wel- ders	Wire- less oper- ators.	Over- seers
I. Agriculture & Community Development														
(a) Food & Agriculture														
(b) Community Development														
TOTAL														
II. Irrigation & Power														
III. Small Scale Industries														
IV. Industries & Mining														
(a) Heavy Electricals, Bhopal														
(b) Public Sector														
(c) Steel, Mines & Fuel														
(i) Coal														
(ii) Oils										2,550				
(iii) Geological Survey of India														

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Engineering Trades

	28	29	30	31	32	33	34	35	36	37
	Die-fitters	Mechanics	Draughtsmen.	Drillers.	Civil—Engg.	Mechanical Engg.	Electrical Engg.	Signalling & Tele-Communications.	Others	Total
I. Agriculture & Community Development
(a) Food & Agriculture
(a) Community Development
TOTAL
II. Irrigation & Power	73,000	73,000
III. Small Scale Industries	11,800	11,800
IV. Industries & Mining
(a) Heavy Electricals, Bhopal	7,509	8,256
(b) Public Sector*	67,900	67,900
(c) Steel, Mines & Fuel
(i) Coal	..	7000	..	..	..	..	..	..	..	23,600

* Estimated on the basis of a ratio of 1 : 18 between Engineers & Craftsmen in the manufacturing industries.
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APPENDIX XI—4

Non-Engineering Trades.

Head	Masons	Mistries	Drivers	Others	Total	Grand Total Engg. and Non-Engg. Trades
	38	39	40	41	42	43
I. Agriculture & Community Development
(a) Food and Agriculture	300	300	300
(b) Community Development
TOTAL	300	300	300
II. Irrigation & Power	73,000
III. Small Scale Industries	2,33,000	2,33,000	2,44,800
IV. Industries & Mining.
(a) Heavy Electricals Bhopal	8,256
(b) Public Sector	67,900
(c) Steel, Mines & Fuel
(i) Coal	23,600
(ii) Oils	91	..	91	3,010
(iii) Geological Survey of India	..	256	256	775

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	1	2	3	4	5	6	7	8	9	10	11	12	13
I (b) Public Sector*
(c) Steel, Mines, and Fuel
(i) Coal	..	4,250	1,400	7,000	1,400
(ii) Oils	5	..	..	35	..	..	..	..	..	..	..
(iii) Geological Survey of India
(iv) Iron & Steel Department
Total	..	4,250	1,405	..	747	7,035	..	..	..	1,400	..	..	..
V. Transport and Communications													
(a) Department of Transport	..	11	31	..	..	34	..	54	..	14	..	..	..
(b) Department of Communications and Civil Aviation	..	20	644	105	3	65	49	63	85	13,102	416	87	65
(c) Railways
Total	..	31	675	105	3	99	49	117	85	11,316	416	87	65
VI. Social Services													
(a) Education
(b) S.R. & C.A.

*Estimated figures.

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	14	15	16	17	18	19	20	21	22	23	24	25	26	27
(iv) Iron & Steel Department
TOTAL	2,550

V. Transport & Communications.

(a) Department of Transport . . . . .	..	..	1	14	..	..	..	..	..	41	..	128	..	..
(b) Department of Communication & Civil Aviation	274	5	24	15	..	..	33	..	50	66	7	25	10	..
(c) Railways . . . . .	..	..	..	..	..	..	..	..	..	..	..	..	..	..
TOTAL	274	5	25	29	..	..	33	..	50	107	7	153	10	..

VI. Social Services

(a) Education . . . . .	..	..	..	..	..	..	..	..	..	..	..	..	..	..
(b) S.R. & C.A. . . . .	..	..	..	..	..	..	..	..	..	..	..	..	..	..
(c) C.S. & I.R.	24	..	6	7	11	5	14	2	10	22	3	16	1	4
(d) Home Affairs . . . . .	..	..	9	12	2	..	4	1	4	4	..	5	7	6
(e) Information & Broadcasting . . . . .	..	..	..	2	..	..	..	..	..	..	..	..	..	..
(f) Works, Housing and Supply	1
(g) Rehabilitation
(h) Health
(i) Labour & Employment	185	216	..	94	177	..	467	..	528

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	28	29	30	31	32	33	34	35	36	37
(ii) Oils	69	2,810	2,919
(iii) Geological Survey of India	250	259	509
(iv) Iron & Steel Department . . . . .	..	..	..	..	..	..	..	..	8,000	8,000
TOTAL . . . . .	..	7,069	..	250	..	..	..	..	86,478	11,184
V. Transport & Communications.										
(a) Department of Transport . . . . .	..	52,018	8	..	..	..	..	..	1,85,964	2,38,318
(b) Department of Communications & Civil Aviation	13	13,528	78	..	..	..	..	..	2,044	30,930
(c) Railways . . . . .	..	..	..	..	3,300	22,800	4,400	2,400	..	32,900
TOTAL	13	65,600	86	..	3,300	22,800	4,400	2,400	1,88,008	3,02,148
VI. Social Services.										
(a) Education . . . . .	..	..	..	..	..	..	..	..	..	..
(b) S. R. & C.A. . . . .	..	..	..	..	..	..	..	..	..	..
(c) C.S. & I.R.	8	71	..	..	..	..	..	..	234	666
(d) Home Affairs . . . . .	..	5	2	..	..	..	..	..	..	118
(e) Information and Broadcasting . . . . .	..	4	..	..	..	..	..	..	..	8

	38	39	40	41	42	43
(iv) Iron & Steel Department . . . . .	..	..	..	11,824	11,824	19,824
TOTAL . . . . .	..	266	91	11,824	12,181	1,23,365
V. Transport & Communications.						
(a) Department of Transport	13	..	1,72,089	268	1,72,370	410,688
(b) Department of Communication and Civil Aviation . . . . .	..	3,000	1,311	5	4,376	35,306
(c) Railways . . . . .	..	..	..	..	..	32,900
TOTAL	13	3,060	1,73,400	273	1,76,746	4,78,894
VI. Social Services.						
(a) Education . . . . .	..	..	..	..	..	Nil
(b) S.R. & C.A. . . . .	..	..	..	..	..	Nil
(c) C.S. & I.R. . . . .	..	..	..	43	43	709
(d) Home Affairs . . . . .	..	..	..	195	195	313
(e) Information & Broadcasting . . . . .	..	..	..	..	..	8
(f) Works, Housing & Supply	25,125	1,582	..	3	26,710	45,981
(g) Rehabilitation	27	4	31	47
(h) Health	300
(i) Labour & Employment	712	712	8,739

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1	2	3	4	5	6	7	8	9	10	11	12	13
(c) C.S. & I.R.	4	22	5	42	33	3	50	7	10	19	18	8
(d) Home Affairs	8	2	10	4	8	2	17	4	2
(e) Information and Broad-casting . . . . .	..	2	..	..	..	..	..	..	..	..	..	..
(f) Works, Housing and Supply	1	15,001	..	..	..	..	4,250	..	..	..	..	..
(g) Rehabilitation . . . . .	..	..	..	..	..	..	..	..	..	..	..	..
(h) Health . . . . .	..	..	..	..	..	..	..	..	..	..	..	..
(i) Labour and Employment	267	287	382	348	533	..	799	..	251	281	..	..
(j) Atomic Energy	3	..	..	..	3	..	4	..	..	..	..	..
TOTAL	283	15,314	397	394	577	5	5,120	11	263	300	18	8
TOTAL PUBLIC SECTOR	4,564	17,394	502	1,144	7,711	54	5,237	96	14,779	716	105	73
Housing* . . . . .	..	72,000	..	..	..	..	20,000	..	..	..	..	..
Private Sector† . . . . .	..	..	..	..	..	..	..	..	..	..	..	..
Industry . . . . .	..	..	..	..	..	..	..	..	..	..	..	..
Defence . . . . .	..	..	..	..	..	..	..	..	..	..	..	..
GRAND TOTAL	4,564	89,394	502	1,144	7,711	54	25,237	96	14,779	716	105	73

*Estimated on the basis of an outlay of Rs. 1200 crores for the Third Plan period.

†Estimated figures for chemical industries in the private sector.

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	14	15	16	17	18	19	20	21	22	23	24	25	26	27
(j) Atomic Energy	8	.	.	.	2	.	.
TOTAL	24	192	231	21	107	5	18	188	14	493	3	552	8	10
TOTAL PUBLIC SECTOR	298	197	256	50	107	5	51	188	64	3,150	10	705	18	10
Housing	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Private Sector	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Industry	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Defence	.	.	.	.	.	.	.	.	.	.	.	.	.	.
GRAND TOTAL	298	197	256	50	107	5	51	188	64	3,150	10	705	18	10

	28	29	30	31	32	33	34	35	36	37
(f) Works, Housing & Supply . . . . .	..	13	..	..	..	..	..	..	5	19,271
(g) Rehabilitation . . . . .	..	1	..	..	..	..	..	..	15	16
(h) Health . . . . .	..	..	..	..	..	..	..	..	300	300
(i) Labour & Employment . . . . .	..	..	..	..	..	..	..	..	3,212	8,027
(j) Atomic Energy . . . . .	..	35	..	..	..	..	..	..	..	55
TOTAL	8	129	2	..	..	..	..	..	3,766	28,461
Public Sector	21	72,798	88	250	3,300	22,800	4,400	2,400	3,63,052	5,26,593
Housing . . . . .	..	..	..	..	..	..	..	..	..	92,000
Private Sector . . . . .	..	..	..	..	..	..	..	..	3,83,900	3,83,900
Industry	N.A.
Defence
GRAND TOTAL	21	72,798	88	250	3,300	22,800	4,400	2,400	7,46,952	10,02,493

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	38	39	40	41	42	43
(G) Atomic Energy	306	306	361
TOTAL	25,125	1,581	27	1,263	27,997	56,458
TOTAL PUBLIC SECTOR	25,138	4,908	1,73,518	2,46,660	4,50,294	9,76,817
Housing	1,20,000	7,400	..	..	1,27,400	2,19,400
Private Sector . . . . .	..	..	..	..	..	3,83,900
Industry . . . . .	..	..	..	..	..	N.A.
Defence . . . . .	..	..	..	..	..	..
GRAND TOTAL	1,45,138	12,308	1,73,518	2,46,660	5,77,624	15,80,117

APPENDIX XXII
PLANNING COMMISSION
 (Education Division)
Category-wise distribution of Engineers—1956-66.

DEGREE

Category	1955-56 (Position)	%age to Total	1956-61			1956-61			1960-61			1960-61		
			Additional require- ments according to E.P.C. Report	%age to Total	Strength Added	%age to Total	Position (Cols 2 + 6)	%age to Total	Position (Cols 2 + 6)	%age to Total	Position according to E.P.C. Report (Cols. 2 + 4)	%age to Total	Position according to E.P.C. Report (Cols. 2 + 4)	%age to Total
I	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Civil	.	.	13,200	42.3	12,354	43.6	9,794	37.2	22,994	40.0	25,554	42.9	25,554	42.9
2. Mechanical	.	.	6,800	21.8	5,300	18.7	4,745	18.1	11,545	20.1	12,100	20.3	12,100	20.3
3. Electrical	.	.	7,300	23.4	5,546	19.6	4,615	17.5	11,915	20.7	12,846	21.6	12,846	21.6
4. Chemical	.	.	2,496	8.0	2,256	8.0	1,060	4.1	3,556	6.2	4,752	8.0	4,752	8.0
5. Metallurgy	.	.	593	1.9	693	2.4	475	1.8	1,068	1.9	1,286	2.2	1,286	2.2
6. Mining	.	.	343	1.1	469	1.7	697	2.6	1,040	1.8	812	1.4	812	1.4
7. Tele-Comm.	.	.	281	0.9	1,616	5.7	723	2.7	1,004	1.7	1,897	3.2	1,897	3.2
8. Others	.	.	187	0.6	91	0.3	4,199	16.0	4,386	7.6	278	0.4	278	0.4
TOTAL	.	.	31,200	100.0	28,325	100.0	26,308	100.0	57,508	100.0	59,525	100.0	59,525	100.0

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DIPLOMA

1. Civil	.	.	.	27,700	58.2	29,013	53.9	16,802	51.7	40,502	55.3	[52,713	55.8
2. Mechanical	.	.	.	7,990	19.4	12,192	22.7	4,781	14.7	12,681	17.3	[20,092	21.3
3. Electrical	.	.	.	7,500	18.4	10,355	19.2	3,626	1.12	11,126	15.2	[17,855	18.9
4. Chemical	.	.	.	407	1.0	806	1.5	32	0.1	439	0.6	1,213	1.2
5. Metallurgy	.	.	.	244	0.6	204	0.4	232	0.7	476	0.7	448	0.5
6. Mining	.	.	.	407	1.0	629	1.2	589	1.4	996	1.4	[1,036	1.0
7. Tele-Comm.	.	.	.	8	0.02	608	1.1	550	1.7	558	0.8	616	0.7
18. Others	.	.	.	534	1.4	21	0.04	5,896	18.1	6,430	8.7	555	0.6
TOTAL				40,700	10.00	53,828	100.0	32,508	100.0	73,208	100.0	94,528	100.0

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DEGREE

	1961-66		1965-66		1961-66		1965-66		Remarks
	Strength to be added†	%age to total	Position‡ (Cols. 8+12)	%age to total	Strength proposed to be added‡‡	%age to total	Position**** (Cols. 8+16)	%age to total	
1. Civil	16,700	32.3	39,694	36.3	12,500	27.4	35,494	34.4	†Actual supply of engineering personnel during 1961-66.
2. Mechanical	13,000	25.1	24,545	22.5	11,500	25.3	23,045	22.4	
3. Electrical	12,700	24.5	24,615	22.5	11,000	24.1	22,915	22.2	§§Requirements of Engineering personnel assessed during 1961-66.
4. Chemical	2,300	4.5	5,856	5.4	2,300	5.1	5,856	5.7	
5. Metallurgy.	1,000	1.9	2,068	1.9	1,100	2.4	2,168	2.1	
6. Mining	1,500	2.9	2,540	2.3	1,800	4.0	2,840	2.8	**Position according to the strength proposed during 1961-66.
7. Tele-Comm.	2,100	4.1	3,104	2.8	2,500	5.5	3,504	3.4	
8. Others	2,440	4.7	6,826	6.3	2,840	6.2	7,326	7.0	‡The actual likely position according to the supply of engineering personnel during 1961-66. There may be some
TOTAL	51,740	100.0	1,09,248	100.0	45,540	100.00	1,03,048	100.0	

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